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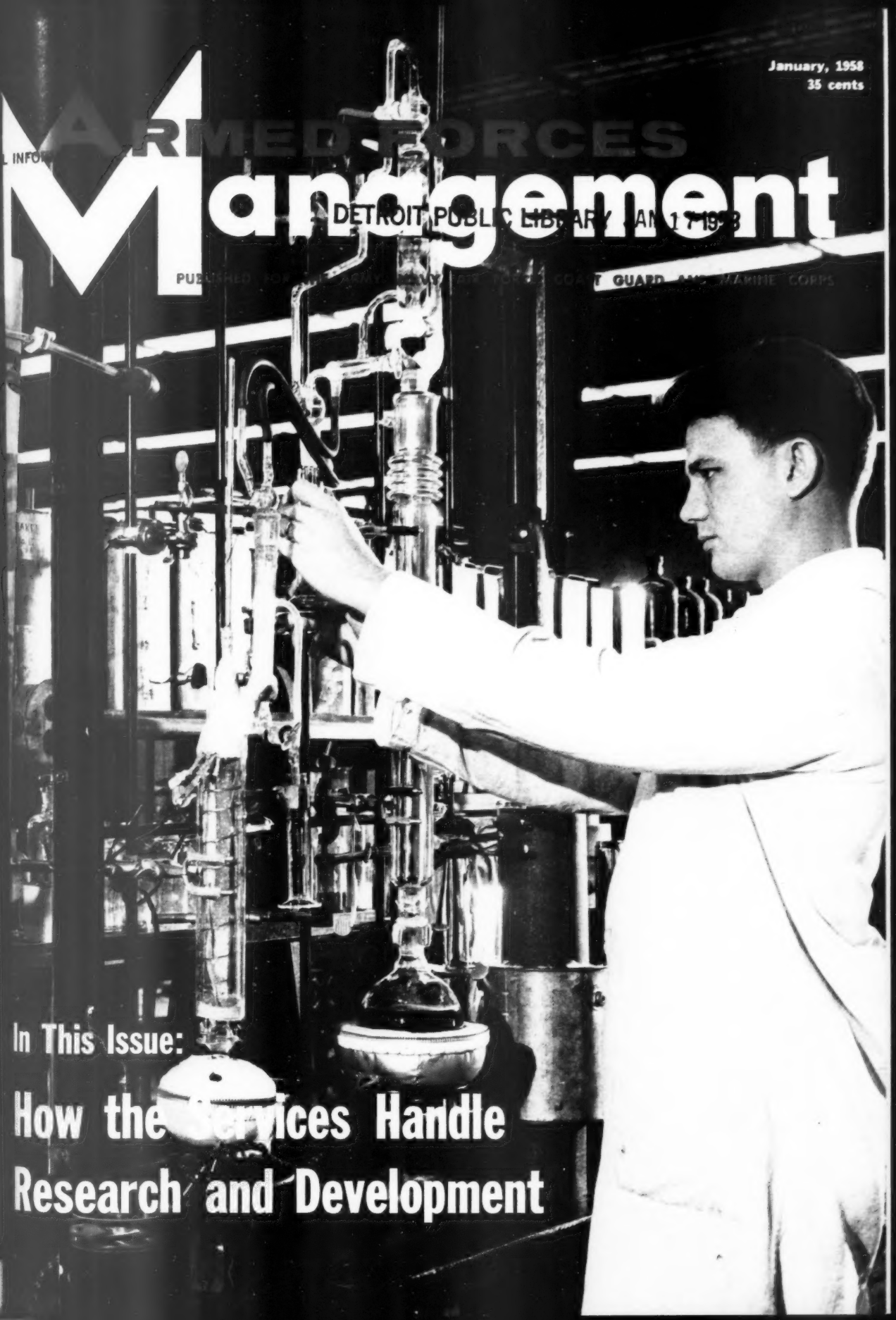

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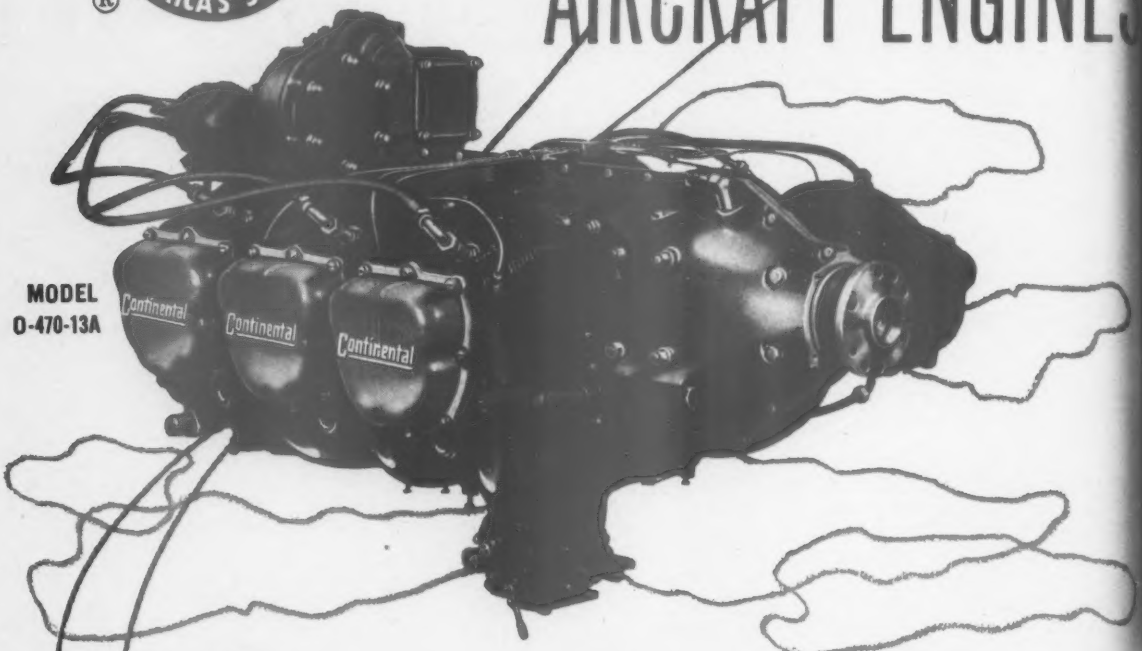

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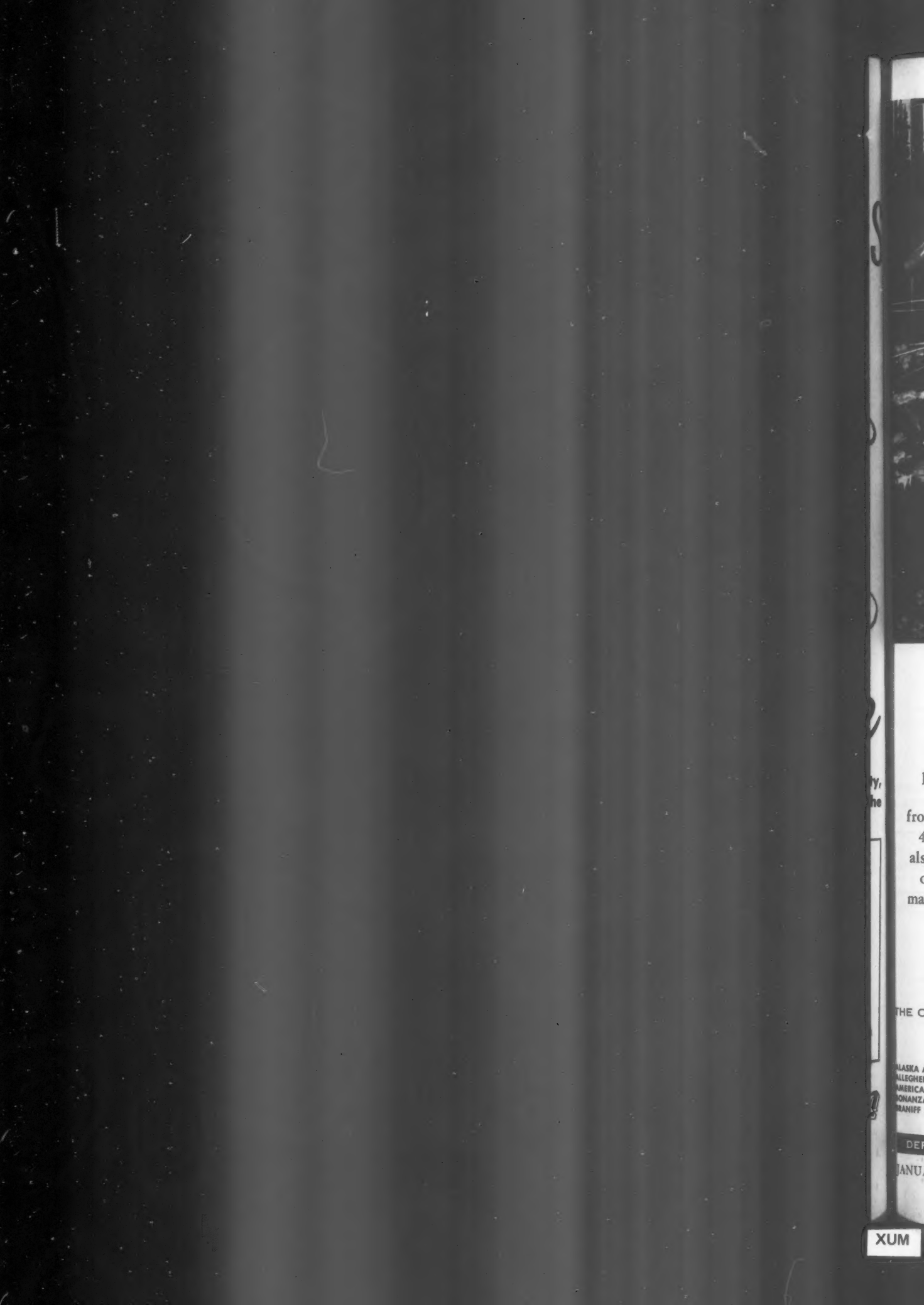

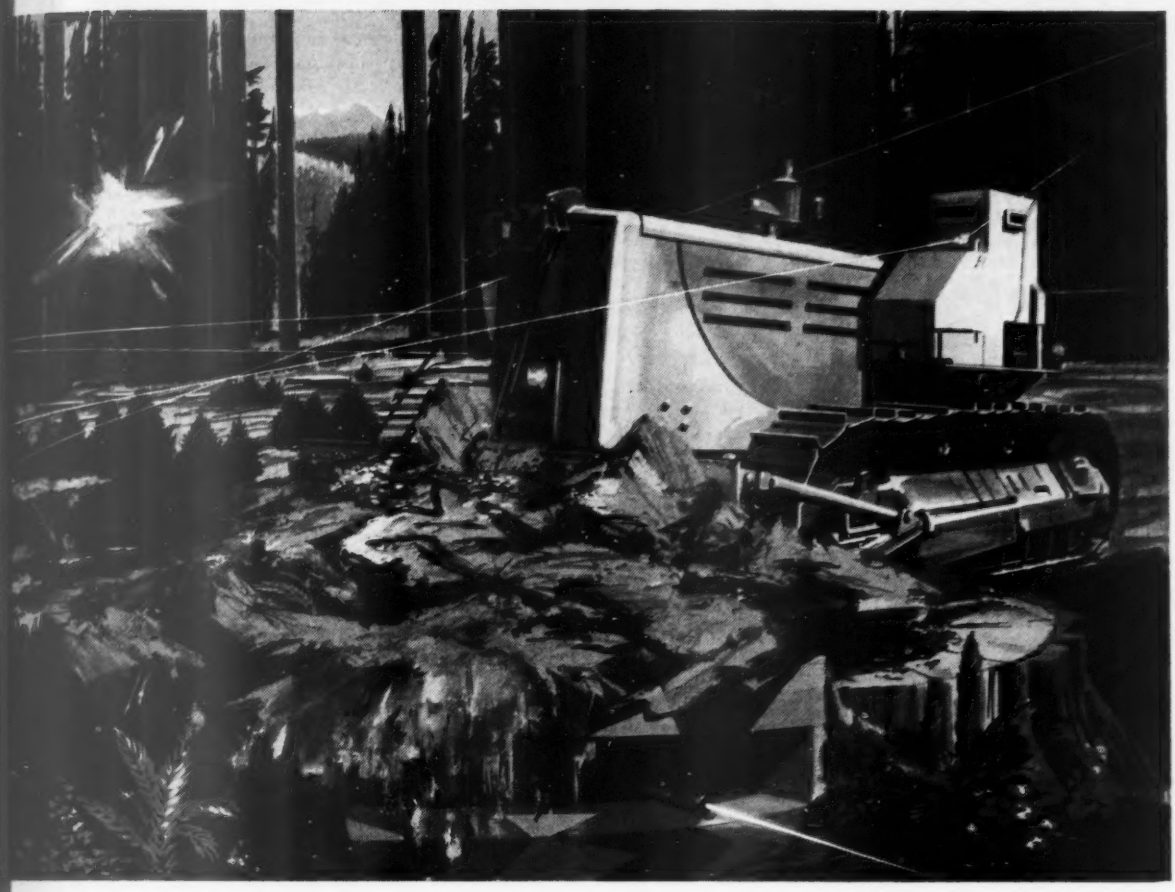

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In My Opinion

Reprints Available

. . . Series on Department of Defense organization is terrific reference volume. Where can I obtain additional copies?

Col. J. E. Cassidy, USAF

The four-issue series has been assembled into a single 140-page volume. Copies are available for $1 from our business office.—Ed.

Not more pay?

Your editorial, "Personnel Turnover —Today's Toughest Military Problem" (Dec. '57), treats the problem as having one cause—too little pay, and as having one cure—more pay; but the following verse from Edgar A. Guest comes forcibly to mind:

For the bigger rewards
It is useless to hope,
If you never can see
Past the pay envelope.

The citizen-soldier in his first enlistment (or induction) who does not reenlist is the specific problem; and this person comes from the same background with the same basic American sentiments as does the person in industry. What have business organizations found out about this person?

Up until about 20 years ago the "scientific management" view prevailed that all a man wanted was pay. But that philosophy turned out to be one extreme of the swing of the pendulum of thought about why men work. The other extreme was the "human relations" factor which set in motion the wave of "programs" with emphasis on the "informal organization." Now the general trend of thought is taking a middle course—that the economic incentive and the pattern of human relations in the organization must be considered together.

Is military thinking forty-five years behind the times? The assertion in 1912 that money was the only incentive has long since been discredited (or outgrown). Yet money, and money alone, is publicized today as being the solution for the military personnel turnover problem. This is true of the Cordiner Committee report, of the press releases from the Department of Defense, and of your editorial. I have seen no mention of the human relations factor or of the effect of the organizational structure on the individual. Why?

It has taken an organized and united revolt (represented today by some 16,000,000 people) to accelerate the recognition of the individual in business organizations as something more than a simple economic man who sells himself for pay. This revolt has had the sanction of law backed by public opinion since 1933; and the force in the revolt is the strike.

In the military there can be no open strike—that would be mutiny; thus military organizations have not been forced to keep pace with business organizations in matters of human relations and organizational structure. The strike of the citizen-soldier occurs at the end of his first enlistment when he has a choice. As your editorial states, the choice is for industry and the summation of all of the choices is in the high military personnel turnover rate.

The Department of Defense (and the Cordiner Committee) appears to have decided to compete with business organizations for the services of the young American citizen; and, according to published information, it is basing its campaign on pay alone. While the military pay structure can be improved and the differential with respect to business may be lessened, it is generally admitted that it can never be competitive, dollar for dollar.

But, as we have tried to point out, the selection of pay alone as the critical factor is something that business organizations left behind decades ago. To be truly competitive, the military will have to compete in more than pay. It will have to include human relations and the structure of organization in its campaign. These latter do not require the financial ammunition that the pay factor does. They do require new concepts about the individual and his place in the organizational structure; and new concepts are often more difficult to get than is an appropriation of money from the Congress.

Leland B. Kuhre
Colonel, USA-Ret.

Admittedly, the services probably need much improving in the human factors and organizational area. We contend, however, that the citizen-soldiers right now are "striking" primarily for more pay. Over the long haul the balanced program you mention is probably the better solution, but, unfortunately, these are limited-scope, crash program times.—Ed.

Bouquets

It was indeed a pleasure to review your October issue of ARMED FORCES MANAGEMENT and find such an excellent presentation of the functions of the Department of Army general staff. In addition to its explanatory value, I think it will be widely used as a handy reference for members of the military establishment as well as your civilian readers.

Maj. Gen. H. P. Storke
Chief of Information
Department of the Army

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JANUARY, 1958

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ARMED FORCES MANAGEMENT **Volume 4—No. 4**

Roy B. Southworth, Executive Director

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The Glacier breaking ice in McMurdo Sound. Mt. Erebus in background. (Official U.S. Navy Photo)

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USS Glacier driving through pack ice in Ross Sea. (Official U.S. Navy Photo)

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EDITORIAL

Does the Defense Department Need A Single Chief of Staff?

IT IS becoming more and more apparent with each issue of the daily paper that the Department of Defense is an appallingly misunderstood organization, even by some of the people who work there.

Current example is the strong Congressional move to reorganize the Joint Chiefs of Staff setup. Sens. Stuart Symington (D-Mo.) and Ralph Flanders (R-Vt.) have pushed for legislation to unify the military command at the top; Sen. Prescott Bush (R-Conn.), a Senate Armed Services Committeeman, has called for an amendment to the national security statute to "set up a general staff organization with a single head man"; Rep. George Mahon (D-Tex.), chairman of the House Military Appropriations Subcommittee, has urged a sweeping reorganization of the whole Defense Department because having the Joint Chiefs of Staff serve in the dual role of military planners and commanders of individual services is "unrealistic and unworkable."

What is reorganization supposed to solve? Basically, it is supposed to help end "service rivalry" and "mismanagement of the missile program." Why is a new organization unlikely to solve the problem any better than the old one? Again, very basically, because the organization does not provide *the solution* to problems. It merely provides a *new perspective* for viewing the problems. The problems still exist and their solutions are still in the hands of the *people* in the organization.

Reorganization, as an academic discussion, can sometimes *aid* people in solving their problems faster and better. Unfortunately, Congress has a record of parading "single-manager-on-the-white-horse" panaceas under the banner of reorganization when, in fact, the new names and new offices are only more layers on top of the old setup.

This same philosophy, unfortunately, has begun to permeate the Defense Department, itself, until there are now special assistants on top of single managers on top of special advisors on top of single responsible agencies, each smothering layer adding its own burden of "requirements" to delay the people actually charged with the work.

There is enough authority vested in the President of the United States and the Secretary of Defense right now to effect fast, definite, sound decisions. The fact that it isn't being used as it could is hardly reason enough for changing the organizational structure.

What are the problems? At the moment, it appears, there are essentially two:

1—The need to obtain *carefully considered* decisions or advice faster.

A new general staff setup to do this is no more likely to be successful than the present JCS committee system structure. Whether the key man is a chairman of the JCS or a Chief of the General Staff, he is still going to have to coordinate with the people in the organization to obtain the information necessary for a *carefully considered* decision. To be sure, the Chief of the General Staff could probably make off-the-cuff decisions faster but at the JCS level of responsibility off-the-cuff decisions are foolhardy, if not invitations to disaster. The very nature of this cold war we allow our foe to wage on her terms means top military planning must be right all the time, if possible. Russia knows she can make an occasional strategic mistake in this War of Science because we aren't going to attack, anyway. Do we dare think that we have the same leeway?

2—An end to the "confusion" of inter-service rivalry.

It is not the organization which is allowing this rivalry to burn unabated. It is a lack of decisive order from the top of the present structure. Is there any reason to believe that a single Chief of Staff could eliminate this rivalry? Why could he do it where a single Secretary of Defense can not? To go one step further, if the Secretary of Defense cannot control his own organization, is it the organization's fault or the Defense Secretary's?

There are two primary reasons, at present, for inter-service rivalry. One is the annual fight for the budget dollar. Until such halcyon days when the Congress sees fit to give the Defense Department an unlimited expense account, each service is going to battle, annually and perennially, for as large a share of the budget as possible. It is hard to see how a reorganization of the JCS is going to change this.

The other reason for rivalry is found in the "law of geometric acceleration," as a Pentagon veteran put it, in the development of new weapons. The massive firepower capabilities of the three services have developed so rapidly they now overlap. There are sound arguments from all three sides on why each should be allowed to develop an even greater share of this firepower. The JCS has been criticized for making compromise decisions rather than dynamic answers to pressing problems. This is a result, not of the committee system in JCS as its critics contend, but of an attempt to alter the facts to fit an out-dated definition of roles and missions.

A new arbitrary decision, as was the first one at Key West, is needed in the delineation of roles and missions. New technology has left the last one badly outdated—which aggravates service rivalry.

A single Chief of Staff will only "demote" one grade the argument over which service should do what—and make it more bitter because the proposed change would tend to seal off the present opportunity for free airing of opinions. This would encourage a cancer already prevalent in too many places in both government and business. At a time when the U.S. is in such dire need of strong leaders we would be encouraging mediocrity. There are too many people now who make a career of concurrence. It is becoming very tough, any more, to find men willing to take the responsibility of decision.

Where Army Research and Development Is Headed

by Office,
Chief of Research
and Development
Department of the Army

This is an age of such accelerated scientific and technological advance that the fantasy of yesterday is the reality of today. Requirements for defense have given great impetus to this scientific revolution. As a result, rapid development in two fields especially—nuclear weaponry and rocketry—has inspired new concepts of warfare. . . . . .

NO ONE doubts that the United States, our Allies and the Soviet Union will continue to create newer and more deadly weapons systems as we advance the frontiers of human knowledge. Future arsenals will include not only intercontinental ballistic missiles, but effective anti-missile missiles. The knowledge gained from earth satellites will furnish a springboard for eventual space travel.

At the same time, it should be remembered that the spectacular weapons systems of today and the future are culminations of years of painstaking research that consumed much time, effort and money. New weapons emerge necessarily from a firm base of experience gained through years of tests and experimentation.

In February 1949 an Army "Bumper" missile established the record-breaking speed of 5150 miles an hour and an altitude of more than 250 miles. This was an epic flight marked by several "firsts." For the first time in history, communication was achieved by radio with an object more than 250 miles above the earth; a two-stage rocket was separated in flight; rocket motors were ignited at high altitudes; and the thermal barrier observed. Observation of the thermal barrier emphasized the fact that special steps must be taken to protect the re-entry body from the high temperatures generated when the missile re-enters the earth's atmosphere. The ability to achieve such protection was demonstrated recently in the successful re-entry of a Jupiter-C nose cone.

Through its Bumper program the Army opened new areas for high-altitude research and missile development. Basic research of this type allowed us to produce operational surface-to-surface and surface-to-air missiles. As an example, Nike-Ajax was the first fully operational surface-to-air missile in the world. This system can defend against the air-supported threat of today and for some time in the future.

Nike-Hercules, which is now replacing the Nike-Ajax, is capable of destroying whole formations of aircraft. This is a second generation weapon with several times the range of Ajax and even greater altitude capability. A further extension of the Nike system, the Nike-Zeus, designed to be capable of defeating the ICBM is under system development.

The broad research base in missiles also has enabled the Army to have now with troops or under development a variety of surface-to-surface missiles. These include the tank-killing Dart; the close support Honest John, Little John, and Lacrosse, the longer-ranged Corporal and Redstone, and the intermediate-range ballistic missile, Jupiter. Honest John, Corporal and Redstone are now operational.

Throughout the post-World War II years the Army laid special emphasis on its research and development program to assure that the United States would have the finest and most effective weapons that American inventive genius could provide. In 1955, this emphasis was reflected in a top-level reorganization of the Army staff. At this time the Office of the Chief of Research and Development was established as a general staff agency, co-equal with the Comptroller and the Deputy Chiefs of Staff for Personnel, Logistics, and Military Operations.

How It Works

The Chief of Research and Development is directly responsible to the Chief of Staff for the overall supervision of all Army research and development programs—development of equipment and conduct of research in both the materiel and nonmateriel fields to meet present and future needs.

The seven Army technical services carry the operational responsibility for research and development in the Army—the Signal Corps, Chemical Corps, Ordnance Corps, Army Medical Service, Quartermaster Corps, Corps of Engineers, and Transportation Corps.

Each of the seven technical services is responsible for the actual research and development work within its sphere of interest.

Much of this effort involves contracting with industry and other agencies for carrying out Army research and development projects. The Chiefs of the seven services report to the Chief of R&D on research and development matters. In turn, the R&D Chief advises the Chief of Staff, the Director of Research and Development, and the Secretary of the Army.

It is possible to present a general picture of the way a new weapon or piece of equipment comes into existence. The following brief picture makes the procedure sound rather easy and simple. It is neither.

The procedure is called the research and development cycle. The cycle begins with the stated requirement for the weapon or equipment, very likely from the U.S. Continental Army Command (CONARC). Following this,

the item is designed. A prototype is then built. Engineering, or laboratory testing follows. If the item meets this test, it goes to the prospective user for further tests in the field under simulated battle conditions. If the R&D prototype meets all these tests, it then goes into production under supervision of the Deputy Chief of Staff for Logistics.

Included in this procedure are several integral, specific steps. A set of broad military characteristics is prepared by CONARC. A project is established. Feasibility studies are then usually undertaken. If these studies look promising, a development contract is awarded to a qualified prime contractor. A system demonstration by the contractor follows. This is followed by engineering tests conducted by the appropriate technical service. As indicated above, the system receives its acid test by the user. This "user test" is made by the appropriate CONARC Test Board. A "troop test" by a tactical unit completes the test cycle. Where practicable, tests are conducted concurrently or otherwise combined. The engineer and user tests are frequently combined.

Pre-planning

This combination recalls a procedure we have designated "engineering for production," which is coming into greater use. At the early design stage in the R&D cycle, production engineers come into the picture. These specialists consult with the designer of the item so that the design will reflect fully the limitations and other realities of production. The design must be adapted as well as possible to production techniques and procedures that will effect the greatest economies in manpower, time and money.

Jupiter is an excellent example of engineering for production. As early as May 1956, Chrysler engineers went to the Army Ballistic Missile Agency at Huntsville, Alabama, to work with the designers of the missile. By working with ABMA designers, Chrysler engineers were able to assist in modifying development weapons, including Redstone and Jupiter, so that the weapons were suitable for volume production without further modification or re-engineering. For example, prototype fuel valves were redesigned so that valves could be produced by Chrysler immediately and in volume. This paid dividends. The action of the Secretary of Defense ordering Jupiter into production will involve no costly delay. When Mr. McElroy ordered this production, more than 400 Chrysler engineers were at work with ABMA specialists at Huntsville.

The major task and a continuing problem is to insure that research programs of today provide the equipment, weapons, and materials required for the future battlefield. There are a number of general, and specific problems. The long "lead time"—the period from an item's conception to its use in the field—is an example of a serious general problem. Specific problems include the need for better propellants in the rocket and missile field. Research has provided improved propellants, but the energy limits of chemical combustion with ordinary compounds is being approached rapidly.

The Army aircraft family today consists of more than 10 different aircraft. The objective is to reduce the types by approximately 50 percent. The new aircraft will perform much the same work as currently performed but must do so more efficiently. The reduced number will also lessen training, maintenance and logistical support. There are no delusions about the difficulties to be encountered on this road.

Research and development of new conventional weapons and equipment for tomorrow's soldier has not been slighted. For a long time the United States may have to cope with the "brush fire," or limited war. New small arms and equipment necessary for success in this type of conflict included the M-14 and M-15 rifles. The latter replaces the Browning Automatic Rifle. The M60 is designed to fire the 7.6mm NATO round. It replaces three present weapons as a general purpose machine gun.

Other new equipment includes an effective one-shot flamethrower light enough for paratrooper use; the "Dan Patch" mine planter, designed to lay extensive mine fields; radar equipment which can locate enemy mortars in seconds; and a 3.5-inch rocket capable of destroying any known tank.

Some Problems

For greatly increased land mobility we are studying a variety of new types of faster, lighter, more durable and less complex vehicles. An example is the new "Mechanical Mule," an 830-pound vehicle which can transport 1,000-pound loads.

A serious problem on land lies in the limited range of tanks between refuelings. What is needed is a fuel containing high energy per unit weight. Successful work toward a multifuel tank engine is a forward step, but the search must be continued for superior propellants in both liquid and solid form.

Another great concern is the effect of atomic weapons on personnel and equipment. Thus far, the Army has developed radiation detection instruments, shielding materials, and techniques and equipment for prediction and warning systems, as well as procedures for decontamination of materiel. Basic research has paid excellent dividends, but it still must provide the answers to many military problems. Basic or exploratory research in the sciences, both physical and biological, will contribute to revolutionary advances in Army weapons, communications, transportation, and the well-being of the combat soldier.

Impressive Development

The Army has the ability to meet these challenges. Developments already are impressive. The Jupiter IRBM and the future anti-missile missile will be towering deterrents to aggression. Research and development for the Army's organic aviation will produce an extremely effective and versatile fighting force.

Conventional developments will include three new tank types promising even greater firepower, mobility and speed.

Army research may make it possible to man the free world's northernmost ramparts. It is not possible now to live and function effectively in the severest polar weather. To overcome these hazards tunnels have been made into the Greenland icecap. There, on an experimental basis, experiments with travel on foot or on wheels are planned during 1958-59. Already troops are billeted and a multitude of things are stored there.

In the Army of tomorrow the individual soldier will play an increasingly important role. He is becoming a highly skilled radar operator on whom reliance is placed to conduct surveillance over hundreds of miles of air space. He checks out missiles and atomic weapons. He controls unprecedented firepower. It is easy to envision him at work with numerous products and processes which are now familiar chiefly to highly trained scientists and engineers. For example, soldiers now service the liquid oxygen and alcohol-fueled Redstone missile. This event marks a new step forward in the application of science to battlefield problems. Combat soldiers will be working with an extremely low-temperature product. They are thus entering the field of cryogenics as they have already entered such fields as atomic power and space flight.

Most of the more distant future of Army R&D is probably not yet even on the drawing boards. Many of its products may resemble nothing blueprinted today. But the Army is building for that future on a firm base.

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How Navy Research Will Operate

by **Rear Admiral Rawson Bennett**
Chief of Naval Research

The Chief of the Office of Naval Research outlines some of the new plans for improving Navy research administration.

SINCE research and development is concerned not only with hardware but also with ideas and services, the administration of this burgeoning program has presented many new problems which have been gradually worked out. This is particularly true of basic research, for which large-scale government support is a comparatively recent innovation. In fact, there was little support of any kind for pure research prior to World War II.

In August 1946 the Office of Naval Research was created by Act of Congress. The responsibility of the Chief of Naval Research is to promote, encourage, plan, initiate, and coordinate naval research. The language of the Act also points out that ONR is the single office within the Navy Department which is to make available to all Navy bureaus and activities worldwide scientific information as well as the necessary services for conducting specialized and imaginative research. This early centralization of the Navy's research efforts provided the Navy with an effective means of working with the scientific fraternity, on whom the Navy must rely to carry on much of the research, particularly basic research that is required for further military development.

It has been only in the past decade that there has grown a realization in this country of the importance of basic research in the research and development process. Basic research involves investigation in broad scientific areas with no specific use or development in mind. The scientist is searching for new knowledge in his particular field which may not be applied for several years since it may take that long for new theories and new principles to be developed and proved. Military development cannot wait for that process to be completed but must rely on scientific information already developed and available—knowledge in stock, so to speak.

Objective

Basic research conducted under ONR contracts contributes to the general storehouse of scientific knowledge. The primary objective of ONR is to make certain that sufficient investigations are being carried out in scientific areas of interest to the Navy so that new major naval developments can be accomplished 10, 15, or even 20 years from now. The decisions as to which scientific fields are to be supported by ONR are the responsibility of the Chief of Naval Research. In making these decisions, he draws on the advice of some of the best scientific talent in the nation.

An illustration of how basic research contributes to development is the result of fundamental studies in solid state physics that have been conducted for several years. ONR is one of the agencies that has supported work in this field, which is concerned with expanding science's limited knowledge of the properties that make up solid matter. Out of this work, which has already produced the transistor, has recently come the maser, a new device that can amplify microwaves without increasing background "noise." This is not an electronic process but depends on molecules. Although the researchers were not aiming at meeting a military need, the application to radar is obvious. Eventually radar equipment using masers will be built which will radically extend detection ranges.

Actually, the Navy's development program is quite separate from our basic research program, except that unless the Navy helps to maintain a nationwide, stable, energetic basic research effort, military development would gradually slow down and might even sputter out. Development programs are the responsibility of the individual Navy bureaus stemming from the operational requirements established by the Chief of Naval Operations after consultation with the bureau chiefs and the Chief of Naval Research. Applied research tied in with a development program may be handled by the bureau responsible for the program or by ONR in conjunction with that bureau. An example of the latter is the one-man helicopter which was developed jointly by ONR and the Bureau of Aeronautics.

Trend

Ever since ONR's inception, th has been a general trend toward a mo integrated Navy research program, meshing ONR's broad program with the more specialized research programs, including some basic research, of the bureaus. This was carried out largely by ONR, although in an informal way, through its responsibility for coordinating research. At the same time, as the Navy's programs took us deeper into science, it became increasingly apparent that there existed a common scientific foundation for different kinds of development and that therefore research and development should be woven more closely together.

This movement toward greater integration and coordination of research and development was formalized beginning in 1954 when the Navy initiated a series of marked changes in its administrative setup for research and development. These changes, which are still in the build-up stages, were made after a study of the organization of the Navy Department

by the then Under Secretary Gates.

In June 1954, the Secretary of the Navy assigned to the Chief of Naval Research the additional responsibility for coordinating the development phases of applied research and development. For the first time, a central point was established for the technical coordination of the many development programs carried on by the bureaus. It also meant that coordination of research was to be formalized and intensified. The overall coordination responsibility is carried out in ONR through a Director for Research Coordination and a Development Coordinator.

Research coordination, as in the past, concentrates on improving the flow of information among persons actually performing research. Occasionally, it endeavors to sharpen a program or to accelerate the channeling of results into the applied research and developmental areas. This is done by the case study method. A technical field is studied from an overall viewpoint to see exactly how far it has advanced and to point out potentialities for military application.

Three-step Review

The Development Coordinator heads a group of engineers and scientists, who serve as a fact-finding staff. They gather data on development programs and correlate this material so management can utilize it as a basis for decisions. What is called a "three-dimensional" review procedure has been set up for this purpose. First, *types* of equipment are compared to judge whether the Navy is taking advantage of technical advances and also whether there is unwarranted duplication. Second, the *functions* of various equipment are analyzed in order to insure that a proper combination of techniques are utilized to accomplish the desired purpose. Finally, a tactical or warfare area is examined to see whether related items of equipment designed for use in that particular area are compatible and mesh together properly.

Since the coordinating responsibility of the Chief of Naval Research requires complete knowledge of the latest development progress, there is now being developed a "cradle-to-the-grave" status report on each weapons system and each support system. It is estimated that it will take about two years to perfect and install this comprehensive reporting system, at which time it will cover the entire development program.

It should be emphasized that the centralizing of coordination of all research and development in the Office of Naval Research does not imply control. The Chief of Naval Operations, as noted earlier, is responsible for developing new concepts for fleet operating systems. The bureaus continue to be responsible for developing and providing the ships, aircraft, and supporting equipment—in other words, the fleet hardware. ONR continues with its primary task of carrying out the research necessary to provide new knowledge to nourish these programs. Briefly, the Chief of Naval Operations has the basic responsibility for planning, the bureaus for doing, and the Office of Naval Research for learning how to do it.

The Future

The integration of Navy research and development received further impetus when Admiral Burke, the Chief of Naval Operations, in December 1956 signed an instruction which formalized the Navy's general concept of weapons systems. He directed that future planning for development would be in terms of integrated weapons systems and support systems. It will take several years for the systems concept to mature. The Navy's development program for fiscal year 1959 will, for the first time, contain an initial shopping list for some fully integrated systems. This will be augmented by a program of research and supporting development directed at the components, materials and techniques for these systems. During the next two years, the massive task of converting operational requirements into statements of needs for integrated weapons systems will take place.

The next logical step was the establishment of the lead bureau concept, which was approved by the Secretary on August 1, 1957. Under this concept one bureau is assigned complete technical and budgetary responsibility for planning and directing the development of a particular weapon system or support system. This lead bureau works out the budget for the development of the system and receives the entire pot of money appropriated for that purpose. This bureau would then, in effect, contract with the other bureaus to provide the system elements for which they had special technical competence. The transition to this new method of operation will again require at least two years to complete.

In line with these recent changes, there has been a major addition to our administrative machinery. This is the new position of Assistant Chief of Naval Operations for Research and Development. His job is to correlate all weapon and support systems, approve all operational requirements proposed by the warfare divisions under the Chief of Naval Operations, and to approve the technical development plans that the lead bureaus propose in response to approved operational requirements.

These are some of the major adjustments that have taken place during the past three years, which indicate the direction in which research and development administration in the Navy has been evolving. We are engaged in integrating separate, diverse but related segments so that naval research and development can be viewed and directed as an entire whole. At the same time various phases of the Navy's program, particularly in the research area, are carried on as joint projects with the Army or Air Force or both when we deal with mutual problems, such as electronics. One service usually administers the contract with the other services contributing funds.

This overall trend of closer coordination and liaison has helped to ease the task of the Department of Defense in administering the research and development programs of all three services. It has also helped us to achieve interservice coordination in general and effective unification.

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Research and Development— Key to Air Supremacy

by Lt. Gen. S. E. Anderson
Commander, Air Research and Development Command

Soviet scientific competence was already known as early as 1950. Here's the ARDC answer to recent scare headlines about our "failures" to stay ahead.

NOW that the American public's interest in the spectacular launchings of the Soviet Sputniks has abated somewhat, let's bring that accomplishment sharply into focus. Without wanting to belittle the twin Soviet feats of orbiting artificial "moons" around the earth, several U.S. satellite facts stand stark against published "fiction."

First, the U.S. never considered itself in a race with any nation to launch the first artificial earth satellite.

Second, the U.S. from the start disassociated its satellite and long-range ballistic missile programs from one another.

Conversely, the Soviets combined these two development programs into one single, concentrated effort.

Militarily, the successful launching of the Soviet satellites merely demonstrated competence in several significant areas of long-range missile progress.

By no means did the launchings shift the balance of military power.

But what about our own long-range missile program—and progress? Do we trail the Soviets in this area? What are we doing to insure Air Force superiority and supremacy in the coming space age? What is the current status of Air Force research and development?

For the answer to those questions, we must look to the Air Research and Development Command.

Several years prior to the end of World War II, U.S. military men teamed with scientists in researching and developing a new weapon. For the first time in the history of warfare, the soldier and the scientist combined their efforts to meet a single specific military requirement.

During those years, the scientist with his slide rule, the chemist with his formulas, the mathematician with his equations, the physicist with his theoretical calculations of mass and matter, and the soldier with his knowledge of the *art* and *science* of warfare joined forces to forge the most destructive weapon known to man—the A-bomb.

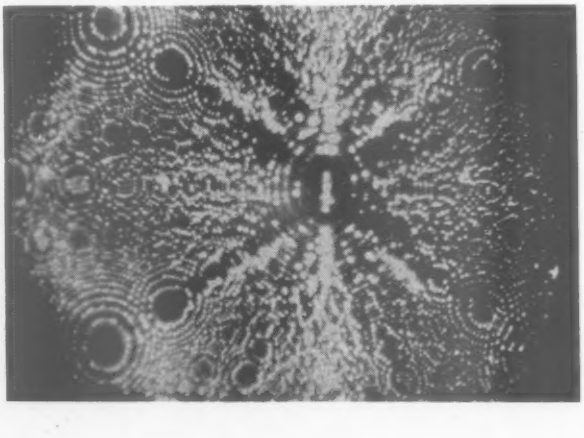
Teamwork paid off. On August 6, 1945, the science-military team proved it had produced a single weapon system more destructive than all World War II efforts to date. The dropping of a single A-bomb from the B-29 "Enola Gay" onto the city of Hiroshima, Japan, ended World War II.

Overnight, concepts of the art and science of war changed. Logistics, tactics and strategy necessarily received a complete overhaul. We had entered the atomic age.

At that time, our scientific lead in the development of a new and formidable weapon was assured. No one questioned our technological superiority. Few doubted our aerial supremacy.

But in the entire history of world warfare, no single weapon ever long dominated the art and science of defense or offense. The A-bomb was no exception. Nor will intercontinental ballistic missiles be exceptions.

After World War II, interest in research and development in the United States blossomed. New pathways in radio, radar, and other electronic areas were probed by scientists.



RESEARCH RESULT. One valuable research tool developed by technicians is the Ion Field Emission Microscope. Known as the electron microscope, the equipment enables engineers to study the physical makeup of materials. Scientists now can actually look at atoms, once considered invisible.

Experimental planes of fantastic speeds—more than 2,000 m.p.h.—were flight-tested. Pilots rocketed to heights of 20 miles and higher into and past the stratosphere in experimental flights to test, among other things, the extent of man's physical and mental endurance.

Meanwhile, military men realized that, although we were recording rapid research and development progress, so were the Soviets. They knew that the country's technological lead in many scientific areas was dwindling; had, in fact, been dwindling steadily since the world's first A-bomb drop over Hiroshima.

Example?

Only four years later, the Soviets scored their own technological breakthrough and detonated their own A-bomb.

About this time, the late General Hoyt S. Vandenberg, then U.S. Air Force Chief of Staff, became concerned with the R&D pace of weapon systems. So did civilian authorities. As a result of such thinking, a committee was appointed to investigate the possibilities of placing more emphasis on R&D. The committee was headed by Dr. Louis Ridenour, then Dean of the Graduate College of the University of Illinois.

Briefly, the committee's findings revealed a requirement for centralizing R&D management under a single organization with strong central command and leadership.

To insure this strong central command and leadership, the Air Force consolidated its R&D activities by establishing ARDC on January 23, 1950.

Dwindling Continues

Almost five months to the day after the genesis of ARDC, the U.S. received added proof that the Soviets were continuing to bridge the technological gap that had previously existed.

Soon after the North Korean Communists pushed past the 38th parallel on June 25, 1950, the MIG-15 began engaging our F-86s. True, the MIG-15 didn't quite match the F-86. But it was a good airplane.

Several years later—in 1952, to be exact—the U.S. reported the detonation of its first thermonuclear weapon. A scant year later, the Soviets duplicated the feat. That same year, the Soviets brought out a new interceptor.

In addition, the Soviets were scoring remarkable progress in radio, radar and other electronics fields, and in materials, chemistry, geophysics, solid sciences, *et al.*

Not long after we introduced our B-52 into the Air Force inventory, the Soviets revealed the existence of a comparable plane—the BISON.

Meanwhile, the threat of a Soviet ICBM loomed large on the horizon. Although a vast and varied Air Force-ARDC missiles development program already existed, military necessity dictated acceleration of the ICBM and the IRBM.

Thus, in 1954, the R&D program for these two missiles was shifted into high gear, or what often is referred to as a "crash" program. Government, science and industry rallied 'round the largest peacetime or wartime project in U.S. history. Not even the Manhattan Project (A-bomb) of World War II fame matched the ICBM-IRBM development program either in complexity or in the number of people involved.

Even today, no fewer than 22 industries are actively engaged in producing our intercontinental Atlas and Titan and the intermediate-range Thor.

Some 80,000 persons, including the nation's top technical and scientific talent, 17 major contractors and more than 200 subcontractors are pitting their skills and brains *against a set deadline.*

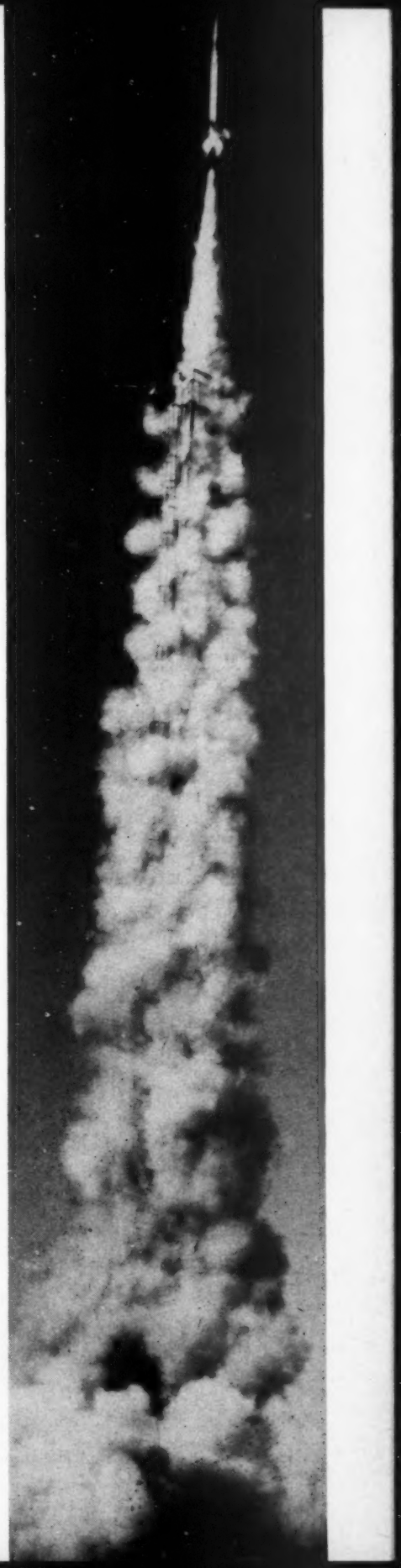
That we've whipped all major problems attests to the engineering, technical and scientific ingenuity of our military-science-industry team.

Today, *all scientific breakthroughs on the two missiles have been accomplished.* Perhaps the most publicized problems revolved around re-entry of the missiles into the heavier atmosphere and accurate guidance systems. Some 20-plus re-entry flights have proved the efficiency of the missiles' nose cone design.

Naturally, much remains to be done. But we are making giant strides forward. Most important, while testing and experimenting, we have not neglected production plans and readiness.

Had we sacrificed production plans and concentrated on spectacular flight demonstrations, we might have bolstered national pride. But we also might have fed national complacency. Such an advantage would have been temporary and superficial at best.

By combining testing and experimentation with production plans, we



AEROBEE HI. Blasting off its launching pad, this experimental rocket is used by scientists to probe the upper atmosphere. Guinea pigs, rats, mice, and monkeys have been rocketed as high as 40 miles—past the stratosphere—and, what's more, brought back alive. Animal experiments were conducted to study weightlessness.

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displayed great good common sense.

Up to this point, we've touched but the bare surface of a single R&D activity.

Let us now review just how R&D fits into the Air Force picture.

Military-Science-Industry Teamwork

ARDC's R&D interests blanket the scientific spectrum and involve every phase of Air Force activity.

Physics, chemistry, biology, aeromedicine, geophysics, nuclear energy, metallurgy and applied mechanics are but a few areas in which ARDC conducts both basic and applied research and development.

An interesting aside is that although our R&D activities are geared to applications of interest to the Air Force, much of our R&D immediately or ultimately benefits civilian industries and our civilian economy.

From our headquarters at Andrews Air Force Base, we direct the R&D activities of 10 centers strategically located throughout the country. Two other organizational projects units, integral components of the command, report directly to headquarters. These are the Armed Services Technical Information Agency (ASTIA) and the Air Force Office of Scientific Research (AFOSR).

Within ARDC, the Air Force Ballistic Missile Division, Hq ARDC, is responsible for managing the top-priority ballistic missile projects—the Thor, the Atlas and the Titan.

The division's commander has been delegated considerable authority to expedite this vital program.

ARDC also staffs an office in Brussels, Belgium, to monitor research projects throughout Europe and the Near East. Basic research is the main commodity purchased by our Brussels office.

To provide technical liaison with industry and other military services, ARDC maintains 26 domestic field offices in the U.S.

As of January 1958, the great majority of our R&D monies was being distributed among nearly 200 universities, colleges and other nonprofit institutions and about 1,500 industrial concerns.

The Future

Long-range planning has and continues to occupy a predominant place in ARDC activities. Selected personnel from across the top of our command structure chair various fields of technical endeavors. Six committees spearhead the various phases of ARDC's long-range planning program.

The areas in which the committees function are:

1). Guided missiles and space vehicles.

2). Propulsion.

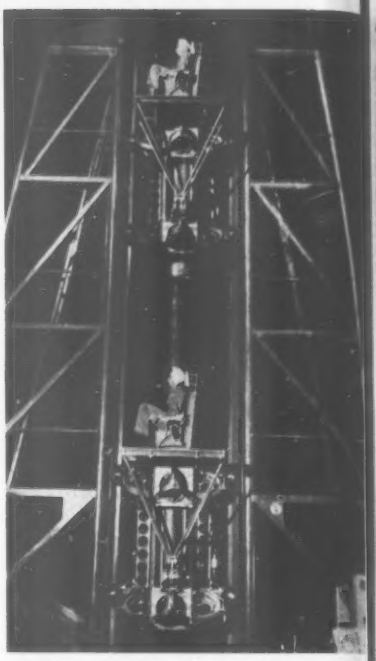
3). Aircraft.

4). Electronics.

5). Materials.

6). Aerosciences including air ordnance; nuclear applications, excluding propulsion; aero biosciences; guidance and control; geophysics; and human factors.

In addition to ARDC's own long-range planning activities, the command has contracted for a series of studies, projected 10 to 20 years into the future, on scientific and technical trends pertinent to the development of the nation's air power.



JUMPING JACK. This double exposure shows the distance the aircraft seat carriage travels on the vertical accelerator developed and constructed for ARDC. In use at ARDC's Wright Air Development Center, the equipment produces a constant 18-foot up-and-down motion at 19 miles per hour providing an accurate method of studying the effects of aircraft buffeting on Air Force personnel.

The contractor is the National Academy of Sciences-National Research Council. Summer-long meetings were held last year to assist the command in establishing its future R&D objectives.

Dr. Theodore von Karman, one of the world's leading authorities on aerodynamics, directs the project. Sessions will continue into the summer of 1958.

Twenty-six universities, 20 industrial firms, and eight governmental agencies are represented by the more than 100 scientists participating in the program.

Why this independent study?

In today's race for aerial supremacy, the Air Force requires an accurate technical forecast to plan such complex weapon systems as supersonic aircraft, ICBMs, anti-ICBMs, advanced communications systems and all the other accoutrements needed to maintain a future tenable military posture.

Such long-range planning represents an intensive look at advanced technical trends and well may foster major technical and scientific breakthroughs, thus insuring continuing U.S.

RESEARCH TOOL. Developed by the Air Force Personnel Training Research Center, this Channel Capacity Interference Device serves ARDC as an important research tool. The equipment can be used to determine the limits of the human operator to perform complex physical tasks while simultaneously making decisions and corrections.

aerial supremacy.

In addition to the technical estimates already noted, ARDC is developing necessary long-range facility requirements to support these technical estimates and the manpower, management and financial plans needed to obtain the long-range R&D objective.

Although plane pilots soon may rocket across the threshold of the earth's boundaries into space, whether or not they bridge that gap will depend much upon today's basic research in dozens of scientific areas and in as many scientific disciplines.

Already working as a team, military and civilian scientists are pushing back the frontiers of knowledge on a dozen different fronts: they combine knowledge to measure the earth's surface, the temperature of tropic and arctic waters, the wind velocities in the upper regions far above the earth, the tensile strengths and weaknesses of new experimental metals, and the physical and mental limits of man.

Others are planning to project missiles at speeds of 15,000 miles per hour or faster along a trajectory over intercontinental distances. Physicists and mathematicians and other scientists are working against time to discover a defense against such missiles. Others project their thoughts even further into the future.

Some scientists are researching means and methods to keep a man alive inside a supersonic vehicle when the heat generated outside would exceed 20,000 degrees—hotter than the very surface of the sun.

In other research projects, ARDC scientists whirl men around centrifuges to study their reactions to violent motion. They rocket men skyward at supersonic speeds to 20-25 miles and higher above the earth inside research planes to test the strength of metals and man's physical and mental endurance. They subject humans to extremes of heat and cold and atmospheric pressures to gauge man's capacities under stress.

As we peer far into the future it becomes increasingly obvious that basic research will benefit the end product of our Air Force efforts—"hardware" that ultimately may act as a deterrent to aggression, or if attacked, will insure survival of the nation.

Scientists must learn more about the effects of geomagnetic storms in the ionized layers in the atmosphere, of the aurora, and of meteors for future Air Force operations. Specifically, they must be able to predict operationally important variations in these parameters, and, if successful, military men will be able to use these phenomena to their advantage.

One wonders why the concern with meteors when the highest that man has blasted through the atmosphere while inclosed in a self-contained atmospheric vehicle is some 26 miles.

Meteors hold several hazards for man rocketing through space—large particles that can puncture the thin skin of a plane flying at hypersonic speeds (over five times the speed of sound); dust particles that will erode the surface of a vehicle and produce small pits and general deterioration.

Already scheduled for study is additional information on meteors which ARDC will gather from rocket flights over the next few years.

Future Problems

In ARDC's basic research programs, we have already gathered by-products in entirely different fields from those pinpointed, after pure exploratory research has been conducted merely to satisfy academic curiosity.

One excellent example has been the work of Dr. Walter Gordy at Duke University. Dr. Gordy's research, originally aimed at microwave spectroscopy, led to important advances in an apparently unrelated scientific discipline—namely, molecular biology.

By its very nature, basic research produces negative results. Conversely, research recoups a failure through the discovery of a valuable by-product in another area. In one particular basic research project, scientists, studying a photographic process, contributed significantly to our understanding of creep in metals.

Basic research within ARDC continually produces new problems as greater knowledge is gathered. New problems, in turn, breed additional scientific progeny.

But basic research does weave the invisible design that is our source of radar, defense weapons, missiles, and future space superiority.

Likewise, it opens the avenues to military supremacy in today's air age and tomorrow's space era.

Man today stands at the very threshold of space. Basically, what he seeks is the conquest of the unknown. R&D will bring that goal into being.

● **The Department of the Army has developed an "electronic weatherman" capable of spotting high-altitude indications of oncoming storms, hurricanes, tornadoes and other bad weather far faster and more accurately than any previous device. It is the first system able to chart high velocity winds like the jet stream on a routine basis, the Army said.**

New Ideas

Filing System Simplified

Reported by: U. S. Army Chemical Procurement District, San Francisco.

Improvement: Simplification of purchase order/contract filing system.

Background: Purchase order and contract files were set up in jackets by the Procurement Division immediately after placing the order and making distribution. The jackets were sent to Administrative Services, where filing of all documents pertaining to the purchase orders or contracts was the responsibility of that Office.

Before Improvement: Administrative Services, not being familiar with purchase order and contract documents, required an excessive amount of time for filing the documents, and in some instances, documents were misfiled, or a backlog of filing work was accumulated. This necessitated searching for documents needed for current work, and, in some instances, an unusual amount of time was lost before required documents were located.

After Improvement: The purchase order/contract filing responsibility was transferred to the Procurement Division, where it remains until the purchase order or contract is completed and closed out by the Contract Closure Officer, at which time the completed purchase order or contract with all related documents is forwarded to Administrative Services for filing in the central files. All documents, including copies of payment vouchers, pertaining to purchase orders or contracts are forwarded to the Procurement Division for filing. Any information required on current purchase orders or contracts is readily available in the Procurement Division. When follow-up action is necessary, all the information is immediately available. Personnel familiar with the purchasing and contracting transactions handle all requests for follow-up actions or other information in connection with procurement activities.

Gains: Using trained procurement personnel for filing all documents pertaining to purchase orders and contracts until the purchase order or contract is completed, has resulted in an average of 35 man-hours per month saved in searching for documents, and an overall net saving of 17 man-hours per month for the filing of documents. This results in an estimated average monetary saving of $1,000 per annum.

Management Technique Used: Methods improvement and work simplification.

Research and Development

■ **The Army Scientific Advisory Panel** is urging that action be taken to **improve the management of research and development.**

In a letter to **Army Secretary Wilber Brucker,** Panel Chairman **Frederick L. Hovde** said, "Whatever **the failures** may be, they are **primarily** those of **management**—in which we have a **share**—which result in delays in decision making and confusion in the direction of our technological forces."

The panel unanimously recommended the following:

(1) Redefinition and clarification of **the roles** and missions "where this is possible."

(2) Freedom and authority for each **service** to carry out the research and development effort necessary to discharge its obligations.

(3) A "clear-cut" definition and recognition of national missions which require support of two or more services, i.e., continental air defense.

(4) Creation of an "effective" mechanism for directing research and development effort to support these national missions.

(5) The improvement of the management procedure of "decision-making" throughout the entire national defense structure, objective being the elimination of "present confusion regarding authority and responsibility."

■ **The Navy** announced recently what it termed "a major forward step" in the development of its highest priority program, the **Polaris ballistic missile,** with an award to **Lockheed Missile Systems Division** of a $3,000,000 contract for construction of a Polaris development facility at the missile division's Sunnyvale, Calif., plant.

The new building will house under one roof the centers of Polaris development—testing facilities, engineering, planning, administrative support and Navy administration.

■ **The organization** of the Research and Development Division of **Allen B. Du Mont Laboratories, Inc.** into eight specialized laboratories under centralized control and direction has been announced.

According to **Robert T. Cavanagh,** director of the division, this new alignment will enable Du Mont to carry out a wide variety of R&D programs directly for the military and under subcontract.

■ **Washington** (AFPS) A tank-mounted roller to explode mines—scourge of armored vehicles on the battlefield—has been developed by the **Army.**

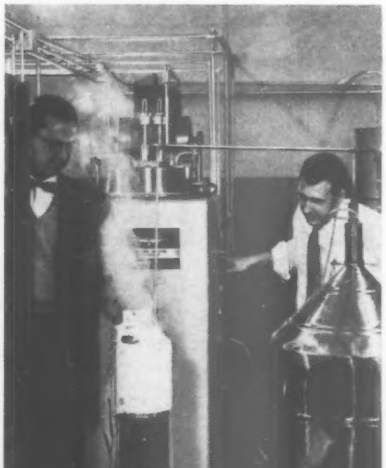
Capable of withstanding antitank mine explosions, the roller clears a safe path through mine fields and eliminates time-consuming search and removal.

■ **The Callery Chemical Co.** is currently working on a new rocket fuel which, they hope, will lock the most efficient practical chemical propellant, a boron-carbon-hydrogen compound, in solid form.

"The significance of this is that it will combine the most efficient type chemical fuel, with the most efficient rocket design, since a rocket with solid propellant requires no fuel transfer mechanism," said **Dr. William Schechter,** Callery's vice president-operations. "The result should be a superefficient rocket."

■ **The Army** has developed a fully-mobile, mechanical mine planter that requires only one man to operate it successfully.

Mounted on pneumatic tires, the planter carries the mines to be planted in a "lazy susan" type machine which automatically feeds them into the planting mechanism. The planting mechanism consists of a device to arm the mines and a side elevating plow that opens a trench into which they are dropped. The plow lifts the turf or soil on its side and after the mine is placed drops the soil over the mine.



Vapor cloud rises from liquid helium, which virtually freezes molecular action through the coldest temperature created by man, as it is transferred from cryostat to special container. Cryostat liquefies helium at –452 degrees F, preparatory, in this case, for delivery to Levinthal Electronic Products for use in special research work for the Atomic Energy Commission.

■ **Admiral Corporation** has undertaken a high-priority program to develop new and more effective electronic countermeasures for the **U.S. Navy**—the only effective defense that can deceive or destroy enemy missiles short of their targets, according to **John F. Gilbarte,** vice president-government laboratories division.

■ **Development** of an "electronic weatherman" has been announced by the **Army.**

The new system spots high-altitude indications of on-coming storms, hurricanes, tornadoes and other bad weather far faster and more accurately than any previous device. It is the first system able to chart high velocity winds like the jet stream on a routine basis.

Developed by the **U.S. Army Signal Engineering Laboratories,** Ft. Monmouth, N.J., the system reduces long, difficult calculations now required to interpret data from a weather balloon flight. It tracks the balloon and a built-in electronic "brain" does the figuring instantly. Winds and weather high above the clouds have a profound effect on ground conditions. Inaccurate or delayed balloon reports could cause a forecaster to give false weather predictions. In battle, a knowledge of the shifting winds of the upper atmosphere is vital in aiming long-range artillery and missiles accurately.

■ **The keel** of the Navy's first guided-missile, nuclear-powered cruiser—**USS Long Beach**—was laid in early December at the **Fore River Shipyard** of Bethlehem Steel Co., Quincy, Mass. Scheduled for completion in 1961, the 721-foot ship will be armed with surface-to-surface and surface-to-air guided missiles; will have a standard displacement of 11,000 tons.

■ **Tornado-like** blasts of air spurting from 110 tiny ducts on its razorblade wings convert the ultrasonic **F-104A Starfighter** from a "speedster" to a "slowster" for landing, report Lockheed Aircraft engineers.

Traveling eight times as fast as the most violent hurricane ever recorded by man, the tiny air blasts serve as "boundary layer control" on the USAF F-104 for slower landing speeds and increased control. First production fighter to incorporate the new safety feature, the Starfighter with BLC can land in less distance than any present-day jet fighter, at touchdown speeds only moderately higher than trainer rates.

by Ludwig Roth
Chief Engineer, Research and Development Engineering, Solar Aircraft Company

Why Teamwork Is Needed In Guided Missile Development

Teamwork is not, by any means, new. What it can mean to the success or failure of today's accelerated missile development, however, is increasingly important. Here, a member of the team which developed the V-2 in Germany tells why.

TODAY on all levels of management, we are confronted with the need for "group dynamics." The successful launching and completion of a program of any magnitude necessarily demands a high degree of cooperative effort among many groups of people, a balancing and integration of specialized skills on every level. This concept is, of course, not new; but it becomes increasingly important to understand just what it means in relation to today's accelerated development programs.

As I look back over my 20 years in guided missile development, one of the most remarkable revelations, to me, is the fact that the most outstanding achievements were made not by individuals, but by groups of individuals working as a team.

This fact is not confined to the area of guided missiles; it has been true of the development of most modern machinery, including aircraft. But it is especially true in the missile field. Why is this so? What, for instance, is the basic difference between a guided missile and a modern interceptor? Is it simply the presence of a pilot—or is it more?

There are those who contend that present-day pilots are little more than machine operators; they would probably change their minds if they could watch a few jet aircraft carrier landings. What we are trying to do in guided missiles is to actually introduce a substitute for the human brain—not in the sense of designing instrumentation that would do any actual "thinking," but by incorporating all possibilities of human action into the missile. To create as perfect a missile system as possible, all of its actions must be coordinated as smoothly as is done in the human body. Such integration can be achieved only by utilizing the accumulated knowledge of specialists in every field connected with the project, and that includes almost every field known to science.

Unfortunately, we cannot compare the missile to a human being existing under normal conditions. We must compare it to a man in an extremely precarious situation. Imagine a tightrope walker perched on a wire high above the rooftops. Even a momentary loss of his sight, his hearing, or any other of his senses or muscular coordination would kill him. In the same way, the failure of any single operation in a missile system will jeopardize the fulfillment of its entire mission.

Both factors—complexity and reliability of operation of an extremely high level—set missile systems apart from other complex machinery. There is absolutely no margin for error in their design. Their development demands knowledge in almost every field of science, and not just a superficial knowledge. It requires a thorough understanding that keeps pace with the most recent developments in every related field.

In former times, even in the early 1900s, it was sometimes possible to find a select group of world-famous physicists who had superior knowledge in the fields of physics, chemistry and mathematics.

The cumulative effects of scientific inquiry during the last 50 years have changed this approach completely. Our knowledge in every field of science has increased to the degree that the human brain does not seem to have the capacity to handle it all. Perhaps if we could combine Teddy Nadler's memory with Einstein's creativity, the problem would be solved. In the meantime, to achieve optimum solutions for certain complex tasks, we have to bring together at least two or more people with specialized knowledge. This is standard procedure, for instance, in major surgical operations in which two, three, or even more doctors or physicians participate, each specializing in a particular phase of the operation.

Consider the most important discoveries of recent years such as the atomic chain reaction and all the subsequent work that has gone into that area, and you can readily understand the importance of teamwork in nuclear development. Significantly, most of this work was done not only by people working hand-in-hand, but by people who shared an important common bond—the bond of confidence in each other's

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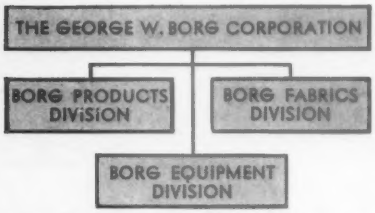
George W. Borg, who founded this corporation, is the "Mr. Clutch" who started with Borg & Beck. He then helped organize the Borg-Warner Corporation of which he became president. Later he served as chairman of the board until he resigned to devote his full attention to The George W. Borg Corporation.



The George W. Borg Corporation is comprised of three divisions

- **Borg Products Division** Manufactures automotive clocks.
- **Borg Fabrics Division** Manufactures deep-pile fabrics best known of this line is the fashionable "Borgana" fabric.
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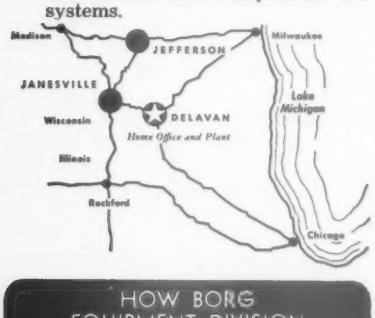

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abilities, mutual understanding, and respect. Important as they are, discovery and invention are only the beginning. Development and production are sometimes even more demanding. It is in this area that teamwork is of such vital importance.

Biggest Problem

As we go from research to development and from development to fabrication, teams have a tendency to grow in size. This is sometimes unfortunate. The possibility of putting together an ideal team diminishes as the size of the team increases. It is this situation that causes one of the most serious problems we have to face in the area of guided missile development.

The number of scientific fields involved is tremendous. We would like to have a topnotch team for each of these fields. This factor alone increases the size of the team and makes perfection progressively less attainable. It becomes the task of the leader to balance top skill in a narrow field with broad knowledge in a wider field but on a lower level; and, since the factors of this equation include psychology and other intangibles, mathematics isn't of much help. As a member of the team which developed the V-2 in Peenemuende, Germany, during the last war, I was able to watch this concept in action. I saw it again when I came to this country to do development work on the Redstone missile and on the Jupiter IRBM. It seems to be as difficult to set up and activate a complex of skills working in balance as it is to produce a tangible object of similar complexity.

The two decades between 1920 and 1940 can be regarded as a period of preparation for the guided missile era. During this time jet propulsion systems, necessary to the success of the guided missile, were being developed intensively. People like Oberth, Saenger, Valier, Winkler, and Tyring in Germany and Goddard in the United States invented systems. Although they did a marvelous job within their confinements, it was possible in almost every case to point out shortcomings caused by the single-mindedness of the inventor.

Credit should be given to the late General Becker, Chief of Ordnance of the German Army, and his assistant, Dr. Dornberger, for creating an environment in which a team could prepare itself for such an immense task. A few engineers, having in common the conviction that space travel could be achieved during their lifetimes, formed the nucleus of the group. Idealists they were, but their approach was anchored firmly on the ground. Realizing that they needed added skills in several fields, they found a few more people dedicated to the work and congenial to the group. Salaries were not a major consideration; German civil service pay was too low for that.

First Test

The first hard test came with the outbreak of the war. Development was ordered scheduled like production work. Personnel were shifted to Peenemuende almost indiscriminately until the installation grew to include many thousands of scientists, engineers, and technicians. This crowding of personnel would have meant the end of our team had it not been such a closely-knit organization to begin with. Gradually some of the new people were integrated into the old nucleus. This hard core lived and worked 24 hours a day, waited for tests at lunch time, and at night sat together discussing its problems. They were not always top scientists in a particular field; more often, they covered several fields.

When the collapse came, the team did not disband. Even though physically separated, they remained a unit—and when the United States War Department called on them they responded as a unit. It is not surprising that after a few weeks at White Sands, without adequate facilities, documents or handbooks, the first V-2s were roaring in primitive stands ready for take-off.

It might appear that this sort of development is possible only under wartime conditions when people are more conditioned to self-sacrifice. But similar developments have occurred in the period since the war. It might also appear that teamwork of this sort might be possible only within one company or one agency. Nevertheless, despite the difficulties involved, complex projects must, of necessity, be tackled by a combination of companies.

Take the development of our large missiles, the IRBMs and the ICBMs. Rarely, if ever, is a single company able to assume airframe, propulsion, guidance, armature and logistics leadership. What is the answer? How do we achieve the integration needed for a really important guided missile? Does each company have to develop all these capabilities independently?

Team Necessary

What is necessary is the creation of a team consisting of a few leading engineers from each participating company. And for these men the same requirements exist that were mentioned before. They must be congenial; they must have confidence in each other and in the project; and they must work and think together. From this beginning evolves a system of teams work-

ing on different levels, all in close coordination with each other.

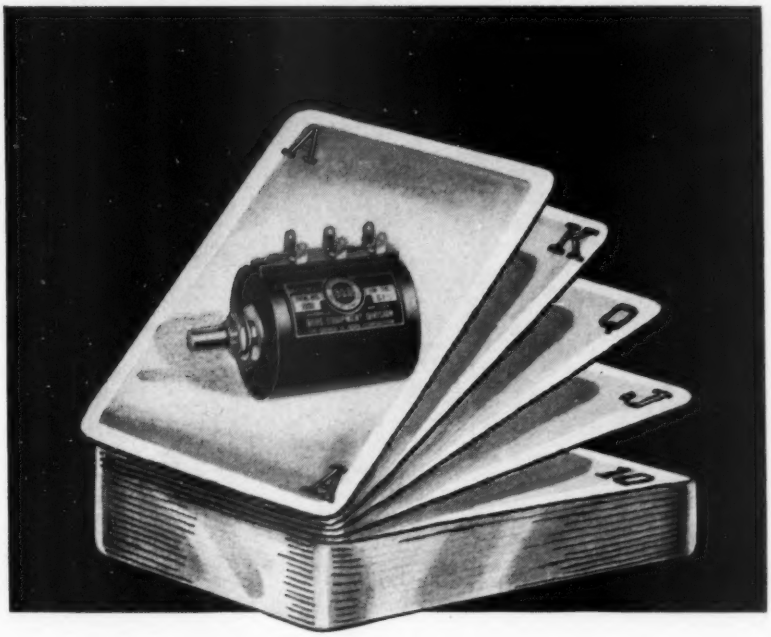
This is a very difficult thing to do, but it can be done. It occurred in connection with the development of the Redstone missile. Three companies were working together on propulsion, structure, and guidance control. The result was not only a fair missile but also a sense of comaraderie among the leading engineers representing the development team. During recent years, as missile development has attained more momentum, people have become more conscientious about certain prerequisites such as reliability and systems engineering. This is especially true in systems engineering.

I recall that during the early development of the V-2, the heated arguments were concerned not so much with technical detail problems as with the whole system, its deployment, use by the services, impact on wartime economy, and so forth. It was therefore natural that we had not only the engineers on our team, but also the men who later would use the missile. To integrate such people into a team is not easy, simply because their viewpoints are so different.

The training of engineers, in general, is of a different order than that of military personnel. However, officers who have done graduate work in specialized fields at institutions such as Cal Tech, MIT, and others will in most instances have some understanding of the approach required of an engineering team. In developing a weapon system, for example, one begins not with the missile itself, but with a great deal of preliminary thinking about the system as a whole.

For this reason, I do not believe it to be sound practice for the services to proceed with the development of specifications without including the missile developer as a participant. Many of the failures of recent years—expensive failures in terms of time and money—can be traced to an approach which has not recognized the importance of integrating all the responsible participants into a closely-linked team.

Though the development of an ideal team obviously requires unusual capabilities in the areas of both interpersonal relationships and technical knowledge, it does not necessarily require a group of people with outstanding skills. For that reason, the possibility of achieving outstanding results in the field of guided missile development is always within our reach—if we can achieve a sound, well-integrated working relationship among the members of the contributing groups, both industrial and governmental.



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The Men Behind The Missile

by Llewellyn Wiley

About the Author

Dr. Llewellyn N. Wiley is a research psychologist with the Air Force Personnel and Training Research Center. He is Chief of the Program Interpretation Branch of the Technical Information and Intelligence Division, and has been with the headquarters of this Air Research and Development Command center since 1951. A native of Virginia, he has lived in several parts of the country, including Rhode Island, Illinois, California, and Texas. He received his PhD in psychology at the University of Illinois in 1940, his MS from Purdue, and his BS from Bradley University. He has taught at the University of Illinois, De Pauw University, UCLA, and the University of California, Santa Barbara College. During World War II he was part of the Army Air Forces Psychological Research Program.

WEAPONS of war are worthless without men to man, operate and maintain them. The rifle is worthless without the man to shoot it.

During the past three years there has occurred a revolution in Air Force methods of manning new weapons. The Air Research and Development Command has instituted techniques for pacing manpower planning with the development of the weapon system itself. The result is that as the weapon comes into being, the Air Force can be confident of the ability to operate and maintain it effectively.

This idea of package delivery of weapon and "know how" will have far-reaching effects in all our armed forces. Such planning may prove to be one of our most successful military advances. From available information it appears that the United States must retain its lead over other nations in military personnel planning to preserve our power of massive retaliation.

How can the Air Force foresee the operational, maintenance, and training problems of a weapon system that doesn't exist? Who knows what problems will arise out of the introduction of a new weapon into the complex defense system of our nation?

The answer to these questions lies in systematic assembly of information, in making logical inferences, and in taking an "educated guess" as a reasonable basis to plan for personnel requirements. Of course the Air Force can't expect to be 100 per cent right—it will have mistakes to correct. However, the big advantage is, as a bowler might say, "in picking up the spares before the frame is gone."

Teamwork underlies every feature of this enterprise. The Air Research and Development Command has centers devoted to the development of each separate aspect of a weapon system, investigating the chemistry and physics of propulsion, experimenting with the configuration of all the surfaces of planes and missiles in flight-contact with the atmosphere, dealing with the elaborate electronic guidance devices controlling the flight of a missile, and so on through an integrated center team. The human element is continuously considered throughout

the development by all centers.

A branch of Wright Air Development Center investigates problems of human engineering—the relation of the hardware to the physiological adjustment of the operator. The Air Force Cambridge Research Center and the Rome Air Development Center have projects concerned with the human operator in complex communication systems. One major center of ARDC, the Air Force Personnel and Training Research Center (AFPTRC), is devoted exclusively to problems of personnel selection, classification, and training methodology. Throughout the development of a weapon system, there is continuous interchange of information among these centers guided by a programmed allocation of responsibilities.

Let us look at the sequence of events which characterizes the story of a weapon system. Let us see how personnel planning synchronizes with "hardware."

Suppose that an enemy has developed a superweapon, an intercontinental ballistic missile, and that the Air Force has seen the need to build a missile which will intercept it.

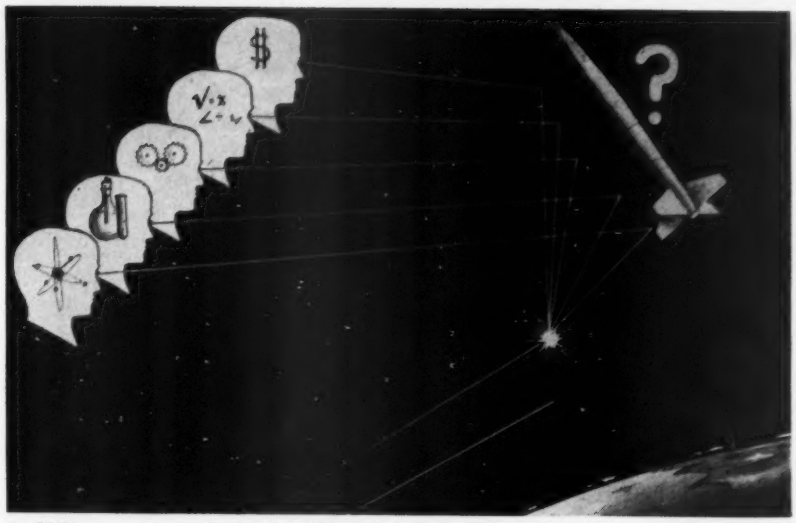
First Step

The first Air Force step would be a feasibility study in which the best scientific and technical minds of the nation join to determine whether a counterweapon is possible. Suppose, as in our illustration, that this leads to the proposal of three designs: (1) a two-stage rocket manned during the first period of its flight, (2) a two-stage rocket launched and controlled from a mother plane, and (3) a two-stage rocket completely ground-controlled.

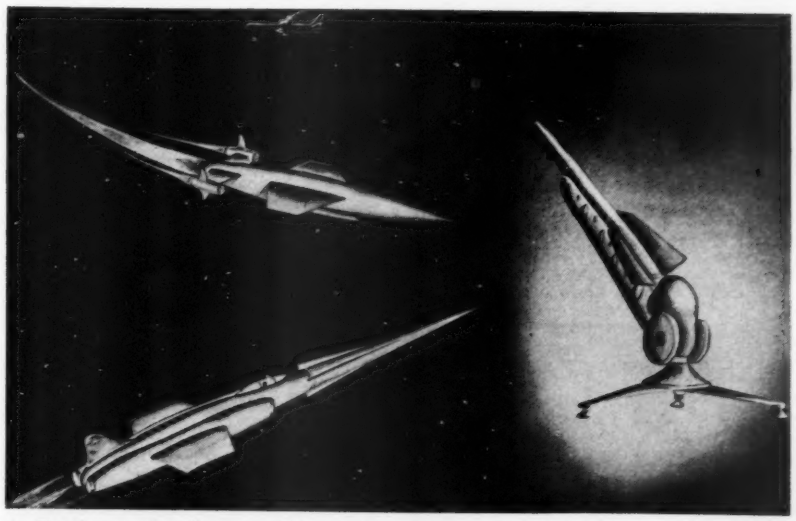
Here it becomes apparent that there are three types of barrier to the effective development of a weapon. There is the familiar physical barrier, involving air resistance; there are also physiological and psychological barriers, which are not generally so well recognized.

Suppose that all three proposed designs are conceived as overcoming the sound and heat conditions involved in the physical barrier. However, the design requiring that the first rocket stage be manned involves too close an approach to the target for the manned segment, with resulting dangers from blast radiation. This design is ruled out because of the physiological barrier.

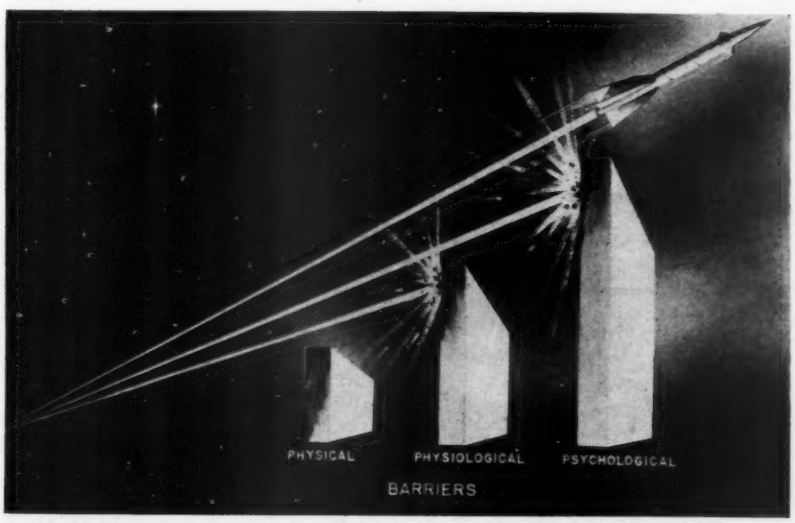
It might be concluded that the mother-plane-controlled rocket will fail to overcome a psychological barrier. This results from the fact that in order to develop a sufficiently fast mother plane, the number of crew members



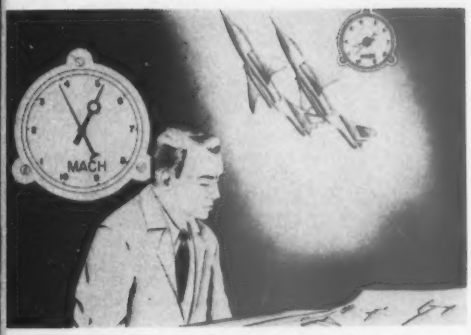
2—Military need results in feasibility study.



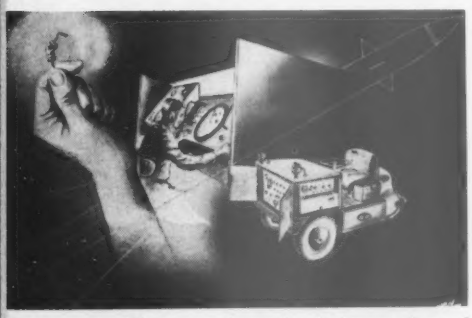
3—Result may be three possible counterweapons—manned rocket, rocket controlled by mother ship, or a ground-controlled rocket.



4—Of the three, only ground-controlled rocket passes all barriers, in theory.

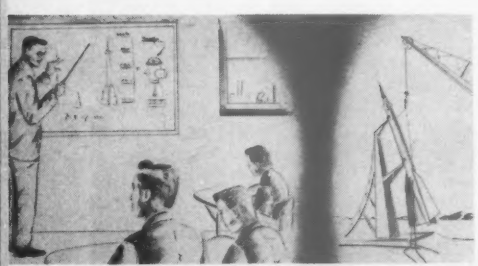


5—Design information is collected to predict maintenance problems, operator problems and training needs. Speeds have special importance in predicting operator tasks.



6—What parts have the designers planned to incorporate? What types of control consoles? Are there automatic maintenance checking devices? Is it possible to predict training problems?

7—Manning problems must be foreseen. Will it take supermen to operate or maintain the weapon system? Must operators work under great strain? In long periods of isolation? Do too many things at once?



8—While AFPTRC is delivering its personnel studies, the weapon undergoes mockup, a prototype is readied for test, and selected crews are sent to the factories for training.

must be reduced to the point where there are too few individuals to handle all the tasks involved in a successful interception.

The last design, completely ground-controlled, is not affected by any of these considerations; it overcomes the physical, physiological, and psychological barriers. Without an adequate technical program of research these factors could not have been foreseen and much time and money would have been expended in developing unfeasible designs.

Data Gathered

As soon as a design has been selected, there begins a process of information gathering. Data are obtained from the industrial contractors. Also, researchers in the human engineering and psychological areas have obtained a great deal of applicable information in their studies of the operation of other weapon systems. Frequently, components planned for the new weapon have already been employed and their useful life is known. From all of this it is possible to anticipate a great many of the maintenance and training problems which will be encountered.

Maintenance information is integrated with information on the availability of Air Force personnel. Some of the components will be familiar to technicians trained on other weapon systems. It will, therefore, be possible to determine who knows what and approximately how much in advance of the emergence of the prototype weapon.

Other information on Air Force operations will also be available. The size of a standard operating organization, for example, will be determined, from the standpoint of both adequate weapon delivery and effective maintenance. Many factors go into this determination, requiring the coordination of Air Force planners with the using command.

The integration of all this information serves to identify areas of manning problems. For the weapon system we have imagined, it is probable that some of the defense bases will be in the Arctic. This alone creates problems of maintenance and of individual adjustment. Will the system be difficult to maintain? Will it require unusual combinations of training and experience? Will it involve operating problems demanding personnel with rare abilities?

While the Air Research and Development Command studies and reports on the personnel problems, the prototype weapon is being carried through the mock-up stage. A test model is then built. Key men have been sent to the industrial plants for special instruction in order to have operator and maintenance personnel available when the contractor delivers the first model to the Air Force. It is they who will go out into the operating squadrons to instruct the first trainees, many of whom come from technical schools to man the new weapon.

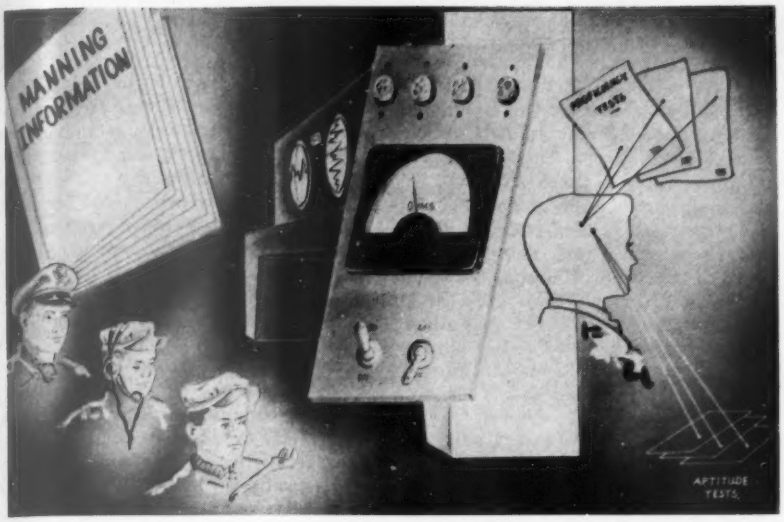
ARDC's Air Force Personnel and Training Research Center has been gathering together the maintenance and manning information and has combined this with information on proposed training devices. Simultaneously with the weapon mock-up, AFPTRC provides estimates of the kinds of men needed to maintain and operate a standard squadron unit, broken down by skill levels. This is accomplished by task analysis. The problem of how to find these men in the Air Force and how to train them quickly and effectively is met by careful analysis of the knowledges and skills which can be expected of a man holding a pertinent Air Force specialty code number. Thus training which capitalizes on skills existing in the Air Force can be specified.

Training Set Up

Training methods for the new weapon system are attacked by determining the critical skills which each man must possess and by applying psychological know-how to questions of how to train skills of the types required. This results in the description of training devices and simulators, an essential requirement for rapid training. In recommending simulator features, it is necessary to keep certain factors in mind. Important among them are ruggedness and economy, because each additional feature of a simulator increases its cost, its size, and the problem of keeping it in working order. By eliminating the unnecessary or very common skills from the task that the simulator will reproduce, early delivery date, lower cost, and increased ruggedness are effected.

AFPTRC also suggests maintenance and training aids, in some cases writing or designing them for Air Force use. Task analysis provides model proficiency tests for maintenance and operator personnel.

Finally, representatives of ARDC are sent to take notes and observe activities at the missile test site or an operational site. Careful task analysis continues in order to check the recommendations previously made on how best to improve operator and maintenance techniques, to conserve manpower, to increase the number of units in combat condition, and to assure maximum safety to personnel. These checks



9—Air Force Personnel and Training Research Center has been busy delivering: (1) manning information, (2) new ideas for simulators and training devices, (3) sample proficiency tests, (4) sample job aids, (5) sample aptitude tests.

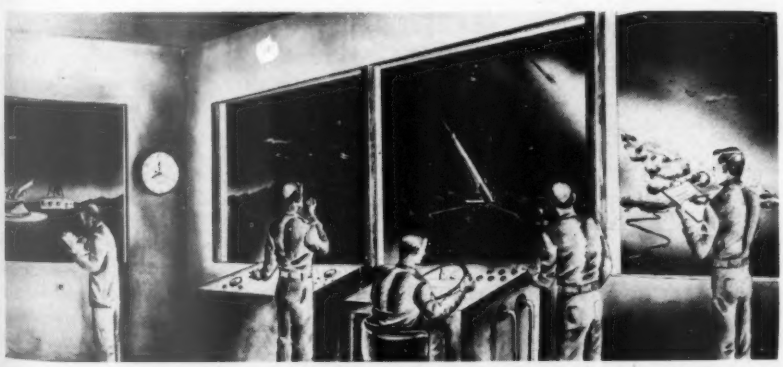
which take the form of systems operations research, also permit better recommendations to be made for the next system.

Such is the course of personnel planning that goes on behind the scenes of a new missile or a new plane. The same personnel planning will eventually accompany the development of a planetary rocket.

Personnel planning extends beyond military requirements. The concept of analyzing personnel needs and providing for them in advance is beginning to be felt in our national economy. Here, unfortunately, in training engineers and technicians, our planning is not ahead of certain other nations. It remains to be seen if such planning can be done without infringing on the rights of the individual. It is time to think of the problem broadly. Major industries may find food for thought in the idea of providing for new personnel requirements as automation replaces manual workers, and as men must be found to monitor and service the machines of automation.

Technological advances are going forward too rapidly to permit a reliance on time to solve all industry personnel problems. Obligations to workers and their families, to cite but one of many factors, will demand that personnel requirements be foreseen and continuously reviewed. This means careful assessment of the reservoir of skills and of future needs.

The impact of systematic planning for personnel needs is just beginning to be felt and can be expected to appear in many crucial elements of American life. Militarily speaking, this planning is a necessity; in civil life it may offer a brighter future for many who might otherwise become technologically unemployed.



10—As the missile is readied for operational testing, teams from ARDC centers and the using commands study the operation of the weapon as an integrated activity, combining AFPTRC, hardware and logistics observations to streamline and improve operation and maintenance.

New Ideas

Army Reduces Supply System Items

Reported by: Headquarters, United States Continental Army Command.

Background: a. Chief of Staff, US Army, directed major oversea commanders and zone of interior army commanders to submit recommendations to Headquarters, United States Continental Army Command, on the reduction of numbers and kinds of materiel in the supply system. The broad criteria was to reduce items of equipment to those absolutely essential to the successful accomplishment of the Army's mission. The resulting action forwarded recommendations to DA for the complete elimination of only 377 items and partial (specific TOE) elimination of only 265 items. b. AR 700-11, June 1956, established the Equipment Reduction Program as a permanent mission of Headquarters, United States Continental Army Command, requiring major oversea commands, ZI armies and Chiefs of Technical Services to submit annually their recommendations on eliminations.

Before Improvement: Previous actions on the reduction program lacked adequate guidance and the delineation of responsibilities. In addition, efforts to eliminate items of materiel had been hampered due to incomplete listings, in Technical Service publications, of materiel actually in the supply system.

After Improvement: Utilizing the management techniques outlined below, this headquarters has forwarded recommendations, across-the-board and in the major problem areas, for the elimination of 5,310 items of materiel in the supply system. A recommendation was also forwarded to Deputy Chief of Staff for Logistics that the Technical Service publications, "Adopted Items of Materiel," be improved by listing all items currently in the supply system.

Gains: On the across-the-board recommendations for elimination, DA has concurred in the elimination of 92.5%. In the major problem areas, DA has concurred in the elimination of 98% of the areas acted upon, vehicles, test equipment, tool sets, photographic equipment, recorders, PA systems, cranes and compressors.

Management Techniques Used: Study, issue of appropriate directives for control purposes, and tabulation by machine records.

Washington News Briefs

■ **Long-range** predictions of what the **U.S. Army** will look like and the enemy threat it will face in 1962 were revealed in the January issue of **Army Information Digest.**

By 1962, the Army will be using **greater** numbers of missiles and rockets, Army aircraft, lightweight armored vehicles, and complex electronic equipment. U.S. Army Missile Commands will be provided in increased numbers and types, including the Redstone ballistic missile—and possibly others—to provide massive fire power with extreme accuracy at varying ranges. The Army of the future will be organized to meet, in order of priority, three possible military situations: cold war, limited war, and general atomic war.

■ **Dan A. Kimball,** president of **Aerojet-General Corp.,** in a recent Washington address, said the trouble with the nation's missile program is in the **Department of Defense** and he proposed a simplified organization that will let the Armed Services develop their own programs under proper supervision. The former Secretary of the Navy said he would eliminate overlapping agencies and double management.

"We should leave it to a new **Director of Missiles** to make firm decisions as to missions and types of missiles—and let the services develop them by proper assignment. These decisions should be made by the Director, and not for him by a staff of Civil Service assistants."

■ **A balance of forces** for defense and a national arsenal of weapons from which any service could draw was called for by **Gen. Maxwell D. Taylor,** Army Chief of Staff, in a recent speech before the National Press Club in Washington.

During next year the Army would have to "rock along" about as it has in 1957, he told newsmen. During the past year, he said, ". . . we have spoken our conviction as to the continued need of balanced forces for defense—not balanced in the sense of numbers or budget dollars, but balanced in proportion to the requirements of deterrence. Such a balance implies a need for related components of land, sea and air forces." As of now, Gen. Taylor said, the **Joint Chiefs of Staff** are having trouble deciding who should develop and then use modern weapons which "the new technology is putting within our reach."

■ **Three heavy cruisers** are scheduled to be converted to **guided missile cruisers** in the Navy's Fiscal 1958 program, according to the **Navy.**

Overall cost of each conversion will be in the neighborhood of $80 million. **San Francisco Naval Shipyard** will convert the **USS Chicago,** now in mothballs, to launch Talos and Tartar surface-to-air missiles. **USS Fall River** and **USS Albany** will receive similar conversions at **Puget Sound** and **Boston** naval shipyards, respectively.

■ **The members** of the **National Capital Chapter** of the **Armed Forces Management Association** heard **Earl Kuhl** speak on "Management Improvement in the Navy," recently. Kuhl's slide-illustrated lecture reported how the Navy Department is tackling the almost-insurmountable problems created by ever-increasing managerial complexities. Kuhl is Director of the Office Methods Division, Executive Office of the Secretary, Navy Department, and co-authored the Hoover Commission's "Task Force Report on Paperwork Management in the U.S. Government."

■ **Washington (AFPS)** The Pentagon plans to redouble basic research programs to develop "novel" weapons of war for the **Armed Forces.** Under a new defense directive broadening basic research policies, the $80 to $90 million now spent annually to solve military problems in the fields of science will be substantially increased. In addition to accelerated programs of creative military research by government scientists, many contracted projects conducted by U.S. colleges and universities, cancelled earlier, will be resumed.

■ **The Air Force** has reverted the **Ground Observer Corps** to a Ready Reserve status due to improvements and expansion in radar for air defense surveillance.

Filter centers and observation posts along the borders and coasts of the U.S., formerly manned around-the-clock by volunteer civilian members of the GOC, will operate only during periods of training, exercises and emergencies.

■ **The Navy** has announced tentative plans to make 10,000 one-step petty-officer-grade proficiency advancements in the second half of fiscal year 1958. The Navy says it plans to allocate the advances to regular enlisted personnel in all **ratings.**

■ **Army Adjutant General Herbert M. Jones** announced an agreement recently with the **Post Office Department** under which military post offices overseas introduced a new, simplified and time-saving **money order system** this month. Under the new system military personnel and authorized individuals may purchase postal money orders without filling out a Post Office money order application.

■ **The Defense Department** is now placing into legislative form a bill that would contain the original Cordiner recommendations plus a six per cent across-the-board pay increase. The proposed pay increase represents the approximate rise in the cost of living since the last pay increase in 1955. If passed, the new bill will raise the base pay of all enlisted men and officers with more than two years service.

■ **The Army** has announced production start-up on a compact, mobile, battle-front **industrial plant** that will make the large quantities of liquid oxygen used in propelling missiles such as the **Army's Redstone.**

Development of the plant, a joint Army-industry accomplishment, solves the major logistics problem of supplying liquid oxygen where and when required and enables the Redstone missile to be employed as a mobile field weapon. The plant will produce 20 tons of LOX a day, is mounted on four large truck-drawn trailers, each jam-packed with machinery.

■ **An airborne maintenance shop** has been developed by the **U.S. Army Engineer Research and Development Labs.** to speed field repair of Engineer equipment. The unit, which weighs 9,000 pounds, meets an urgent need occasioned by the emphasis on extreme mobility of military equipment. Mounted on a standard military ¾-ton truck chassis, the steel-constructed shop can be air-dropped into inaccessible areas.

■ **Eight military districts** in the **First Army** area will be consolidated into two **U.S. Army Corps (Reserve),** the **Army** has announced. The consolidation plan for the First Army area follows similar actions in the Second and Fifth Army areas and part of the Fourth Army area. It is designed to improve the supervision and support of the Army Reserve and effect economies in personnel, funds, and facilities.

How to Increase the Maintenance Manpower Potential

by Lem F. Thom*
Procedures Analyst
Convair (San Diego)
Division of General Dynamics Corp.

ONE OF the major management problems facing the United States Air Force and the Military Air Transport Service today is in the aircraft maintenance field. Both the Air Force and MATS are dependent not only upon the planes and the men who fly them but also upon the personnel who service and maintain them. The acute shortage of trained maintenance personnel has, and will continue to, beset the Air Force and MATS for years to come. Faced with this problem, MATS realized that the most practicable solution to alleviate the situation was to best use the people and resources on hand.

Functional Organization

MATS, to use its available trained manpower potential to the fullest extent possible, reorganized all maintenance functions into a single operational concept. Under this arrangement, the maintenance activities were functionally aligned together and integrated into a single major organization entity. This established the functional area "operational concept" whereby like functions were grouped together and welded into a tight, cohesive operational segment wholly concerned with maintenance work.

The reorganization of all maintenance activities permitted coordination on a manageable scale and facilitated maintenance operations. The power of decision-making was concentrated with a top functional specialist in the field, and was all-inclusive with functional organization. Better work balance and operating results were obtained by combining the different phases of maintenance, performed by three separate activities, into one complete functional alignment under a single head. This widened the extent of delegated authority with a greater degree of decision-making in the maintenance area. It provided the advantage that a person on the spot who is most familiar with the problems was enabled to make better and speedier decisions. It also brought about more uniformity and consistency of maintenance policies and procedures.

Under the functional homogeneity arrangement, the span of control was tightened. (It should be interpreted here that this means an increase in the delegation of responsibilities rather than the number of subordinates which can be effectively supervised.) This is because the less diverse the type of work supervised, the greater the gains of delegation. The span of control was more effective as allocation of two distinct responsibilities was assigned to two separate top functional specialists, and accountability for results could be held.

The reorganization of all maintenance activities was made with a view to increase the available trained manpower skills in this critical area. Advantages of specialization were obtained whereby personnel of like skills, engaged in similar work, were grouped together. Opportunities for training in a wider range of maintenance skills were available so that qualified personnel could fill vacancies in higher jobs. Work was divided to the degree that personnel would be specialists, and their knowledge was increased on the particular maintenance jobs assigned to them. Specialized skills were used to the full. Groups of people comprised more workable, homogeneous and separate fields of endeavor, and the nature of their work was complementary. Better work balance and better maintenance work results were obtained. Depth of training was provided in a specialized area in that maintenance skills were more fully used. A broader base of positions of increasing scope in the maintenance field was provided, so that there were replacements in training for each higher position. This also made available qualified personnel for future management needs in the maintenance field.

Why Reorganization?

MATS reorganization of its maintenance activities came about by individual and group effort, accumulated experience and evolution. It became increasingly apparent that maintenance today is a highly technical operation. It was apparent that the lack of a centrally directed and controlled maintenance program created variations in maintenance operations.

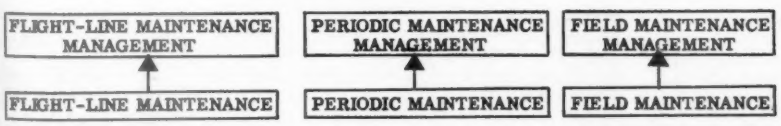
The retention of a skilled maintenance force is a serious management problem. The requirement for highly skilled technicians grows. An aggressive and expanded on-the-job training program offers relief. This requires the best management and control if this critical skill capability is to be developed and used to its maximum potential, and not dissipated in activities which are not functionally aligned together.

How well prepared MATS is to meet the problem only time can tell. While confident as to the outcome, farsighted leadership does not minimize the seriousness of the difficulties ahead. The experience gained thus far does indicate that management must, if necessary, break age-old traditions of military management and use scientific management principles and concepts as applied by industry.

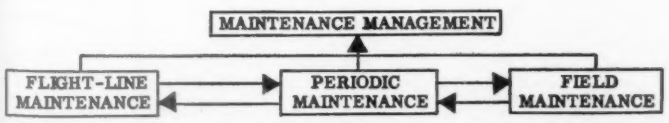
● As in the wars of the past, success in land combat in the foreseeable future will continue to depend upon the proper combination of three essential elements—firepower, movement, and people.

** Former Management Engineer, Headquarters, MATS Pacific Division; now Assistant Procedures Analyst, Convair-San Diego Engineering Department.*

BEFORE REORGANIZATION



AFTER REORGANIZATION



COMMAND AND MANA

The command management cycle shown below was developed
the School's executive development course. In a dynamic or
in the cycle for continuous and organized communication o
may be taken to insure continuity of progress. The comma
ations. It is hoped that this arrangement of essential fun
his philosophy of management.

CONTROL

DETERMINE EXTENT TYPES AND METHODS OF CONTROL NECESSARY.

IMPLEMENT CONTROL PROCEDURES.

COLLECT INFORMATION AND DATA BY ESTABLISHED PROCEDURES.

REVIEW, ANALYZE AND EVALUATE RESULTS.

TAKE CORRECTIVE ACTION.

He accomplishes this through people, influencing their behavior by persuasive leadership rather than resorting to autocratic authority.

COORDINATE

ASSURE LATERAL AND VERTICAL COMMUNICATION THROUGHOUT THE ORGANIZATION.

ESTABLISH SOPs AND ADMINISTRATIVE INSTRUCTIONS.

HARMONIZE PROGRAMS AND POLICIES BY INSURING BALANCE AMONG PLANS AND ACTIONS.

PROMOTE INTELLIGENT COOPERATION AND MUTUAL UNDERSTANDING.

PROMOTE ACCEPTANCE OF ORGANIZATIONAL OBJECTIVES AND INTEGRATE ACTION TOWARD A COMMON GOAL.

In the execution of his mission the command manager directs his operations towards decisive obtainable objectives utilizing minimum essential human and material resources in the best interests of the country.

AGENT ARE SYNONYMOUS

developed
namic org
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ntial func

Command Management School to serve as a structural basis for management functions are interlocked. Provisions must be made appropriate centers of decision so that sound and timely action cycle is equally applicable to tactical and administrative oper- management analysis and help to define for the individual

PLAN

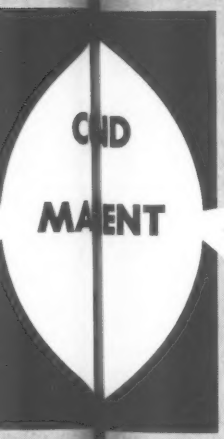
ANALYZE SITUATION TO DETERMINE WHAT IS TO BE ACCOMPLISHED.

DETERMINE AND EVALUATE ALTERNATIVE COURSES OF ACTION.

DEVELOP POLICIES AND PROCEDURES WITHIN WHICH THE PLAN WILL BE IMPLEMENTED.

ESTABLISH MEASURABLE GOALS, ATTAINMENT OF WHICH WILL ACCOMPLISH PLAN.

DEVELOP A PLAN THAT WILL BEST IMPLEMENT COURSE OF ACTION SELECTED.



In the military the commander is the manager. He is assigned authority over others by virtue of his rank or position. He alone is responsible for what his unit does or fails to do.

ORGANIZE

DETERMINE FUNCTIONS REQUIRED TO ACCOMPLISH MISSION.

GROUP RELATED FUNCTIONS.

DEFINE AND ESTABLISH ORGANIZATION RELATIONSHIPS.

ASSIGN RESPONSIBILITIES AND DELEGATE AUTHORITY.

SELECT AND ASSIGN PERSONNEL AND OTHER RESOURCES.

INSURE CONTROL THROUGH AN OPTIMUM SPAN OF MANAGEMENT.

A fundamental function of a command manager is to develop and maintain a loyal, cooperative, homogeneous organization as an effective element of the Army team.

ETERMINE THE DIRECTION NECES

LECT METHOD MUNICATION HICH WILL BE PERTINENT EMENTS OF ZATION THE CTION DES

OTIVATE AND/OR ELEENTS TO ACTION DESIRED. OMMUNICATEMENT.

UPERVISE THE REQUIREENT.

XUM

Industrial Programming Needs Improving

In the field of programming for research, management systems have failed to keep abreast of scientific developments. The line-of-balance technique may be the answer.

by George Mundorff
and William Bloom

THE timetable imposed upon American industry by the exigencies of world affairs requires that the best scientific brains and equipment be put to the most effective use. Current military emphasis on the acquisition of advanced weapon systems within the shortest possible time points up the vital need for instituting more improved management techniques.

Management, in its decision-making role, requires a procedure which will accurately reflect the scope of the program and identify current or anticipated trouble areas. Management must be able to monitor continually a mass of highly complex operations embodying split-second timing of widely disparate organizations. It must be informed of all segments of the operation—financial, technical, administrative, and productive—and must have the capability of digesting a vast mass of seemingly uncorrelated information. In short, management requires a dynamic reporting system not unlike that of a newspaper headline, something discernible at a glance and not subject to unintentional misinterpretation.

The need for balanced and integrated programming becomes increasingly evident as our military equipment grows more complex. Moreover, the shifts in emphasis between our most important weapons systems have had far-reaching effects, not only on military responsibilities, but also on corporate structures.

It is no longer possible for a component manufacturer to proceed along his own selected, independent trail of developmental effort. Actions which once might have been conducted independently now require full coordination to insure that all paths lead to a common goal, integrated according to a single master timetable, and with a guarantee that the results will be compatible with other related efforts. It is axiomatic that the poor performance of but a single supplier will almost invariably negate the satisfactory or superior performance of all others who are engaged in other work on the same program.

Line-of-Balance Technique

To meet the pressing requirements for an industrial programming technique, the line-of-balance system was developed.

It has been used as an effective method of programming a whole gamut of complex operations, from financial planning and logistics to the construction of facilities, from the training and deployment of military units to the scheduling of research and development. In short, line-of-balance can be used to advantage in any operation where time and accomplishments are factors to be measured and evaluated.

It is in the research and development field that a management device, such as line-of-balance, has extremely profitable application. Heretofore, engineering operations—research and development in particular—have been considered a no-man's land, where the scheduling of programs is unknown.

Because of only loose budgetary controls, engineering personnel too often have been guilty of the most unscientific practices in the conduct of highly scientific investigations—frequently with unnecessarily costly results, delayed performance, complications of the problem and usually some loss of good will. Inadequate programming generally has been responsible for a project being reported ninety per cent complete for about seventy-five per cent of the time!

Principles

The line-of-balance technique is based upon the principle of exception. Unlike detailed programming devices which attempt to cover all aspects of the project, line-of-balance presents only the deviations from the plan. In other words, the system makes it possible for top management to examine the sensitive or controlling elements and then to make quick decisions based upon facts furnished from a line-of-balance flow chart.

These facts are derived from data furnished by responsible persons, verified and affirmed by direct observation, and then reduced for succinct presentation in a lucid chart form.

The line-of-balance flow chart contains four principal elements:

1. The Program Plan, which sets forth the controlling tasks to be accomplished, the engineering hours required, the sequence of development and the interrelationships between tasks—all measured against time;

2. The Planned Objective, which represents the goal as well as the performance to be met in terms of dollar expenditures for labor and material for selected key points, measured against time, as shown under the Program Plan;

3. The Program Progress as reflected by bar graphs corresponding to the numbered sensors in the Program Plan; and,

4. The Program Schedule or line-of-balance, which compares actual accomplishments and those which previously were forecast, thus serving to pinpoint problem areas.

Tools

Basic to the technique is the establishment of an orderly and detailed plan for the accomplishment of the project objective. This requires a careful review of all elements which govern the project, since the line-of-

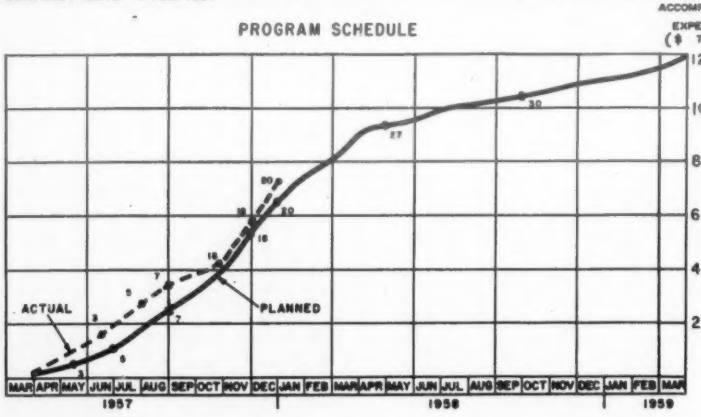
FIGURE NO. 1
DATE: 1 JAN. 1958
X Y Z COMPANY - LAUNCHER SYSTEM
CONTRACT NO. 1276
CONTRACT DATE 11 FEB. 1957
JAN
XUM

CONTRACT NO. 1276
CONTRACT DATE 11 FEB. 1957

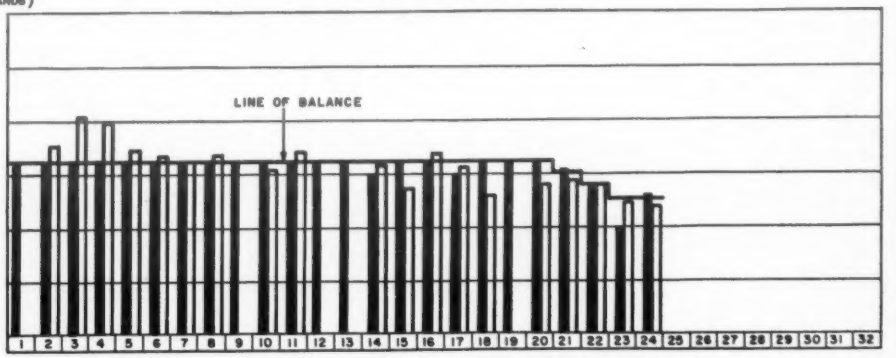
X Y Z COMPANY - LAUNCHER SYSTEM

FIGURE NO. 1
DATE: 1 JAN. 1958

PROGRAM SCHEDULE

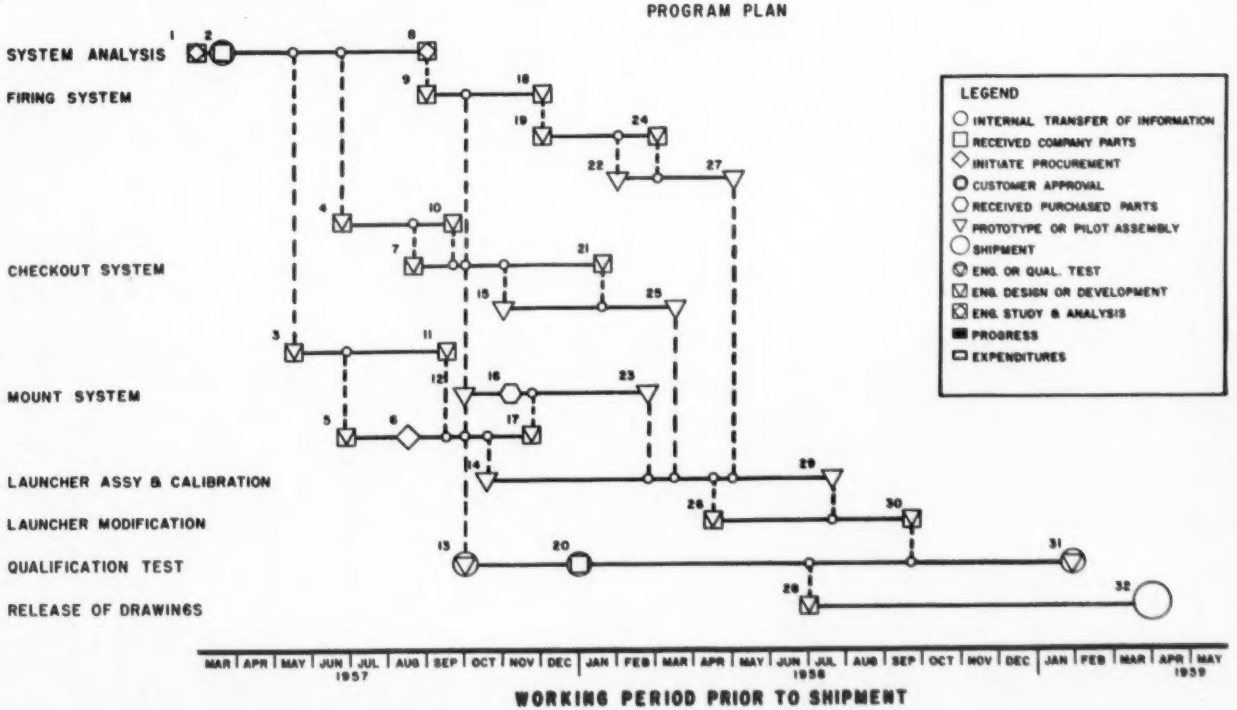


PROGRAM PROGRESS



NO.	SENSOR IDENTIFICATION
1	START SYSTEM ANALYSIS
2	RECEIVE CUSTOMER APPROVAL
3	START MOUNT STAB. SYSTEM DES. & BBD.
4	START CHECKOUT SYSTEM DES. & BBD.
5	START MOUNT MECHANICAL DES.
6	RELEASE WELDMENT DWGS.
7	START CHECKOUT CONSOLE MECH. DES.
8	COMPLETE SYSTEM ANALYSIS
9	START FIRING SYSTEM DESIGN
10	COMPLETE CHECKOUT SYSTEM DESIGN
11	COMPLETE MOUNT STAB. SYSTEM DES. & BBD.
12	START FABRICATE PROTOTYPE MOUNT
13	START QUALIFICATION TEST PROCEDURES
14	START LAUNCHER ASSY & CALIBRATION
15	START FABRICATE PROTOTYPE CONSOLE
16	RECEIVE WELDMENTS
17	COMPLETE MOUNT MECHANICAL DESIGN
18	COMPLETE FIRING SYSTEM DESIGN
19	START FIRING DEVICE DESIGN
20	RECEIVE CUSTOMER APPROVAL
21	COMPLETE CHECKOUT CONSOLE MECH. DES.
22	START FABRICATE FIRING DEVICE
23	COMPLETE FABRICATE PROTOTYPE MOUNT
24	COMPLETE FIRING DEVICE DESIGN
25	COMPLETE FABRICATE PROTOTYPE CONSOLE
26	START INITIAL LAUNCHER MODIFICATION
27	COMPLETE FABRICATE FIRING DEVICE
28	START RELEASE OF PRODUCTION DRAWINGS
29	COMPLETE LAUNCHER ASSY & CALIBRATION
30	COMPLETE INITIAL LAUNCHER MODIFICATION
31	COMPLETE QUALIFICATION TEST
32	COMPLETE RELEASE OF PRODUCTION DWGS.

PROGRAM PLAN



balance technique must be specifically tailored to each project whether it be an airplane, a gyroscope, or a computer.

Once these elements have been established, the construction of the detailed plan can be initiated. The first step breaks down the job into the major and minor subdivisions and then to the smallest elements to be reasonably mentioned. The identification of the specific tasks in relationship to the broad project objective and their relationship to each other is an important step in developing the total plan. The next requirement is to arrange them in sequential order.

Following this, estimates of engineering man-hours and material costs are prepared, based on past experience or extrapolated for untried tasks. These facts must be appraised in the light of available engineering manpower and material, taking into account other jobs in the plant and their demands for the various skills that are available. The lines of communications are clearly identified, indicating the interrelationship of tasks and points at which a careful review of the project is required. It is the preparation of this detailed plan that will point out to many people, for the first time, the specific interdependencies of the elements, the timing that is required, and the critical areas that control subsequent action. This information is used in the preparation of the line-of-balance chart.

Example

To illustrate the use of the line-of-balance technique in the field of engineering, take an actual case—the design and construction of a launching system. *(Based upon the composite experience of other studies, this example contains a number of unknowns similar to other major research and development projects.)*

Careful programming was required on this job, since the budget was limited to $1.2 million and the timetable was restricted to twenty-four months.

The development of a program of this magnitude commenced with a study of the requirements for the system—the system analysis. From this action stemmed all subordinate investigation, including the definition of a specification for the overall program, the conception of various means by which the specification might be accomplished, an evaluation of alternatives, and the selection of the most promising approach.

Once the selection was made, derivation of detailed specifications for subsystems was started, and the development of a block diagram proceeded. There was also detailed planning for the construction and testing of the prototype, and for the release of the production drawings within the budgetary and time limitations.

With the detailed plan available, the key control points were selected for the line-of-balance chart. The chart on the previous page reflects the program plan, setting forth the stages from the start of system analysis to the completion of the project.

It is the program schedule shown on the upper left of the chart which gives an overall picture of the required accomplishments and budgeted expenditures in terms of time and money. By January 1, 1958, the chart shows that total expenditures had reached .660 million as compared with the budgeted amount of .656 million. Delays in the completion of tasks on schedule can be quickly observed. For example, sensor No. 3, which was scheduled for May 15th, was not completed until June 15th (because of delays in the releases of the system analysis).

To represent the actual progress of the program plan, there are two bars corresponding to each sensor point, as shown in the upper right half of the chart. The first reflects the accomplishment of the task. The second indicates the rate of expenditures. The progress of each control point is compared with its own detailed schedule and then converted to the total going rate of the project. This section of the chart permits a comparison of task accomplishment and expenditures as of the survey date. Sensor No. 15, for example, is complete and was accomplished below its budget.

The final section of the chart is the line-of-balance. It is drawn to reflect the level of expenditures and accomplishments which are required to support the program schedule. By comparing the line-of-balance with the bars reflecting program progress, management can quickly identify the status of the program.

The one line-of-balance chart illustrating this article represents the overall basis for appraising the program. It is updated at least once a month to reflect the changes in the program status. In support of the information and using the same principles, a set of charts is drawn on each of the major breakdowns—*i.e.*, system analysis, the mount, the firing system, and system assembly and calibration.

Results

Management used the line-of-balance chart in the launcher program to pinpoint problem areas and take remedial action. At the outset, the initial charts revealed the delays in the system analysis as a result of required changes in specifications. This was reflected in the slippage of the starting dates of mount stabilization design (item No. 3) and the checkout system (item No. 4) and the expenditures in excess of the budget.

The chart also points out the performance and expenditures of each major subdivision of the system. For example, the checkout-system design started behind schedule and above planned cost, but by the start of checkout console mechanical design, item No. 7, the system was in balance. Through changes in the work plan, the design was finished on time and at a cost below the budget estimate (item No. 10). Furthermore, fabrication of the console was on schedule and below cost (item No. 24).

The principal problem area, as shown in the chart, is in the mount stabilization system. Initially, the program was behind schedule because of the delays in the system analysis (item No. 3). An unsuccessful attempt was made to start in advance of customer approval, resulting in further delays and above-budget costs. As of the survey date, the line-of-balance chart reflects (in item No. 17) that the mount mechanical design has not yet been completed as scheduled, and that the cost will very probably exceed the schedule. A careful review of the mechanical design progress is required in order to meet the performance and cost timetable.

Conclusions

In the continuing race for front position in the development of advanced weapons, it is essential that management techniques such as line-of-balance be more widely used. This management technique will greatly improve the timetable and dollar savings by guiding research and development effort along the route of minimum cost.

It encourages operating-level personnel to establish and maintain a detailed plan. This device clearly identifies to them the individuals who are responsible for specific elements of accomplishment. Based upon an orderly and disciplined way of thinking, a line-of-balance chart enables top management to make timely decisions on the basis of an integrated picture of the program; and a contractor is better able to complete his components and systems in phase balance—developing all at an established rate and bringing each in at the time that it is needed. This balance is attainable. In the light of today's events, it is vital to industry and to the nation.

■ **The Marine Corps** announced recently that within a year it will possess a supply system based on **electronic data processing** and transmission which will serve **Marines** throughout the world.

The new system will assist the Marine Corps in operating effectively with minimum inventory. The Corps' current inventory includes some 250,000 separate items with a value of about **1.7 billion dollars.** Increased management efficiency is expected to reduce this inventory.

■ **A contract** for the design and furnishing of reactor compartment components for the **nuclear-powered aircraft carrier** (CVAN) has been awarded to **Westinghouse Electric Corp.,** the Navy announced recently. Contract price is in excess of $46 million.

■ **U.S. Corps of Engineers** spent December opening bids on **six projects** in a construction program at **White Sands Proving Ground.** The six projects, costing several million dollars, are part of the more than **$60 million** planned for the Proving Ground **construction program** for the next three years.

Among the projects to start in 1958 are a missile assembly building for the **Army Ballistic Missile Agency** to store Redstone missiles at the proving ground, a White Sands Signal Agency photo lab, a missile assembly building, vertical launching facility, and a flight simulation laboratory.

■ **Flying safety** officers from 10 centers of the **Air Research and Development Command** met at **Elgin AFB** in December for the sixth annual ARDC **Flying Safety Conference.**

The annual conference is designed to provide an exchange of ideas which will make flying safer. ARDC has one of the best flying safety records in the Air Force and has shown a reduction in the frequency of accidents each year.

■ **Missile Master,** first fully operational electronic air defense control system in the U.S., was put into action by the **Army Air Defense Command** recently.

Located at **Fort George G. Meade, Md., Missile Master** will help defend the Washington-Baltimore government-industry complex against air attack. The electronic system controls and coordinates the fire of the Army's air defense weapons to insure their maximum effectiveness. Targets can be selected economically, with control of each **Nike** missile being retained by local battery commanders. In this way, preselected targets in an attacking air fleet are assigned for destruction by **Missile Master** to individual batteries of a **Nike** network.

■ **The Army** plans to construct its first operating field model **nuclear power plant** in **Alaska.** The site will be **Ft. Greely,** Alaska, 60 miles south of Fairbanks on the Alaskan Highway.

The plant will generate both heat and electricity for the post and will be modeled after the prototype plant in operation at **Ft. Belvoir, Va.** Congress has authorized $6,675,000 for the project. **Construction officers** in the Office, Chief of Engineers, expect about $1,500,000 will be spent for procurement of "long lead" items of equipment on which manufacture must be started well in advance, even before clearance of the site is begun.

■ **Through the** inventiveness of an **Army Signal Corps** man, 1000 inductees can now be photographed daily for identification pictures at the **Fort Dix, N.J.,** training center with an adjusted **Polaroid camera** that shoots two men at one time. Best they could do before was 500 a day. Picture development time has been cut from over an hour and a half to in-camera developing.

The Signal Corps "inventor" discovered that two people could be photographed at one time by removing the stereotach prism of the Polaroid camera, plus lengthening the distance between subject and lens.

■ **The Fort Benning, Ga. Self-Service Supply Center** held an open house in December to celebrate its first $1 million in sales to the 375 military units and activities which it supplies with everything from pencils to wrecking bars. The center, opened last January, is the first in the **Third U.S. Army** area to reach the $1 million mark.

■ **Is "secret" military buying** hurting competition and leading to waste?

No, according to a special study by a private firm issued recently. The report defends the widely criticized military practice of buying by negotiation as "giving the taxpayer better value" than can be obtained by advertising for bids. It disputes recent statements in **Congress** that the armed services' buying methods are a "shield for mischief" and a spawning ground for suspicion and fraud.

The report contends that low bids do not always result in lowest ultimate cost to the military. It says the method is impracticable for buying the new, complex military equipment for which most of the money goes. It holds that buying through advertising tends to drive out quality suppliers and opens the way to poor quality in the items bought by the armed services.

The report closes with eight recommendations for improving military buying, including development of an overall procurement research program for the armed services; a uniform training system for military purchasing people —whom it defends as on a par with their industrial counterparts; public disclosure of all prices arrived at by negotiation; better definitions of military purchasing practices.

Army Engineers' Research and Development Laboratory and USAF have been conducting tests at McGuire AFB, N.J., on air movement of 110 items of engineer equipment and 32 different engineer field units. Major result has been proof of propjet 62-ton Lockheed Hercules' (shown here unloading road machinery and trucks) ability to move up to 20 tons of heavy equipment by air and land safely on improvised airstrips, loading and unloading in matter of minutes by using skatewheel conveyors and truck-level aft ramp.

■ **H. Thomas Hallowell, Jr.,** president of **Standard Pressed Steel Co.,** has attributed recent success of Russian satellites to the Soviet ability to make **all** the parts work.

Speaking before the **American Management Association** conference on quality control, Hallowell said this is a new age of reliability, a technological age vitally affecting both industry and the consumer. Mistakes are daily getting more costly, in terms of both dollars **and** lives, just when they are also becoming more likely. "As a paradoxical result, though the size of things is going up, the little things everywhere are becoming more and more important."

Fig. 1—Addressograph machine room where data is embossed and punched into the Master Writing and Accounting Units.

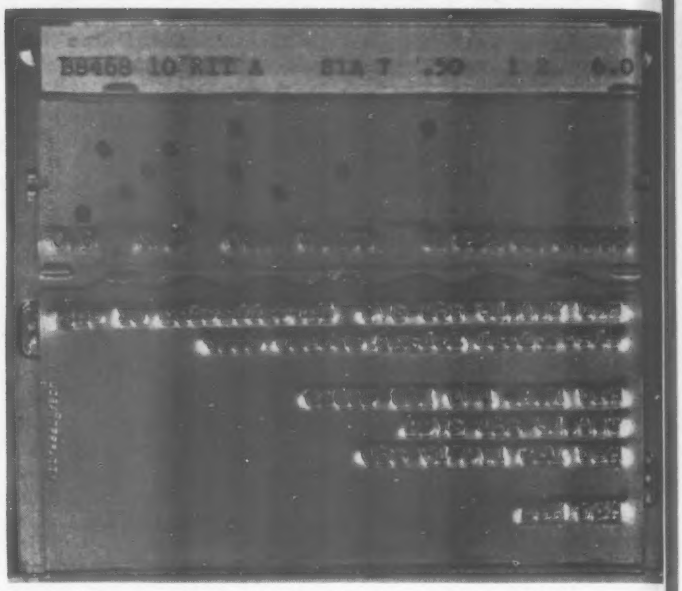


Fig. 2—Master Writing and Accounting plate unit which is the source of all documents, listings, and combination printed and key-punched electrical accounting machine cards.

How Mechanized Control Solves an Aircraft Maintenance Problem

by Richard R. Wolf

Chief, Systems & Procedures Branch, Industrial Engineering Division, Directorate, Maintenance Engineering, Air Materiel Command

One of the most difficult problems faced by Air Materiel Command repair depots is the planning for and scheduling of aircraft repair, overhaul and modification. Here's the AMC solution:

IN ANY system used by the Air Materiel Command, the first criteria is useability in wartime or emergency conditions. Nothing is gained if systems and procedures are developed solely for peacetime operations. In fact, the security of the country might even be jeopardized if conversion to wartime operations could not be made instantaneously.

The Problem

Work requirement determination at AMC repair depots is an extremely complicated problem. The modern aircraft is a highly complex piece of equipment built to withstand the strain of high speed, high altitude, and extreme weather conditions; yet, it is equipped with extremely sensitive and responsive hydraulic, electric, and electronic communications equipment, radar, radio, fire, navigation and bombing control systems and computers.

To this add the variety of operations by pilots and crews of all degrees of experience under every climatic condition in the world, coupled with a variety of special mission equipment installed within the aircraft type, model and series designations.

On top of this endless variety of variables stack the normal overhaul production problems of having the proper material and replaceable items at the right place in the proper quantity at the right time; the properly skilled personnel to accomplish the work; the right tools, handling and test equipment. Then to complete the aircraft maintenance problem, the work must be accomplished in minimum time allowance in the most economical manner.

The Need

The AMC saw an urgent need to mechanize planning, scheduling, assigning of work to specific skills, counting production, measuring effectiveness and costing labor in its repair operation. They needed a system which would, with the minimum of forms and cards, encompass all phases of aircraft production control, labor effectiveness,

production crediting, planning, scheduling, inspection and quality analysis. Further, the system had to be equally adaptable to production line, dock, or job shop operations.

Work on a mechanized system began at Sacramento Air Materiel Area in 1954. The result was a completely integrated system which embraces all production control requirements and also provides for efficient use of manpower, material, facilities and dollars. Based upon the results at Sacramento, electromechanical equipment was purchased for each zone of interior air materiel area that had an aircraft repair functional responsibility. Systems and procedures have been developed for this equipment and are presently being implemented.

The Solution

The system starts with the basic preplanning function—a complete examination of a specific aircraft by a team of production control specialists, industrial engineers, inspectors, and qualified journeyman specialists. This team determines all the predictable repairs that will generate on like type, model, and series of aircraft in active service. This predictable work is then segregated into individual operations, coded to identify both the operation and the location area within the aircraft. At the same time, labor time standards and material requirements are developed and related to the operation code number of the predictable work.

The data established by the team is recorded on an AMC Form 600A. The guide form contains the operation number, work station, control number, aircraft type, model and series (TMS), applicability work on area code, occurrence factor, number of workers, standard hours, type of standard, type of material required, and a description of operation to be performed. This guide serves to instruct the machine room (fig. 1) of the data to be embossed and punched into the Master Writing and Accounting Units. A Master Writing and Accounting Unit is an assembly of two plates in a frame: one plate contains key punch instructions and the other is an embossed printing plate containing the work instructions. This plate unit is the source of all documents, listings, and combination printed and key-punched electrical accounting machine cards (fig. 2).

The completed plate assemblies are also equipped with "Pivloc tabs" for sorting purposes and other identity tabs as required and are filed by operation number, work area, and type, model and series of aircraft. Sets of plate assemblies are also prepared of the inspection guide instructions from the applicable aircraft handbook, and of the technical orders listing applicable to the particular TMS. These sets of plate assemblies are also filed with the operation plates. All this preliminary work is accomplished well in advance of the planned receipt of aircraft for repair.

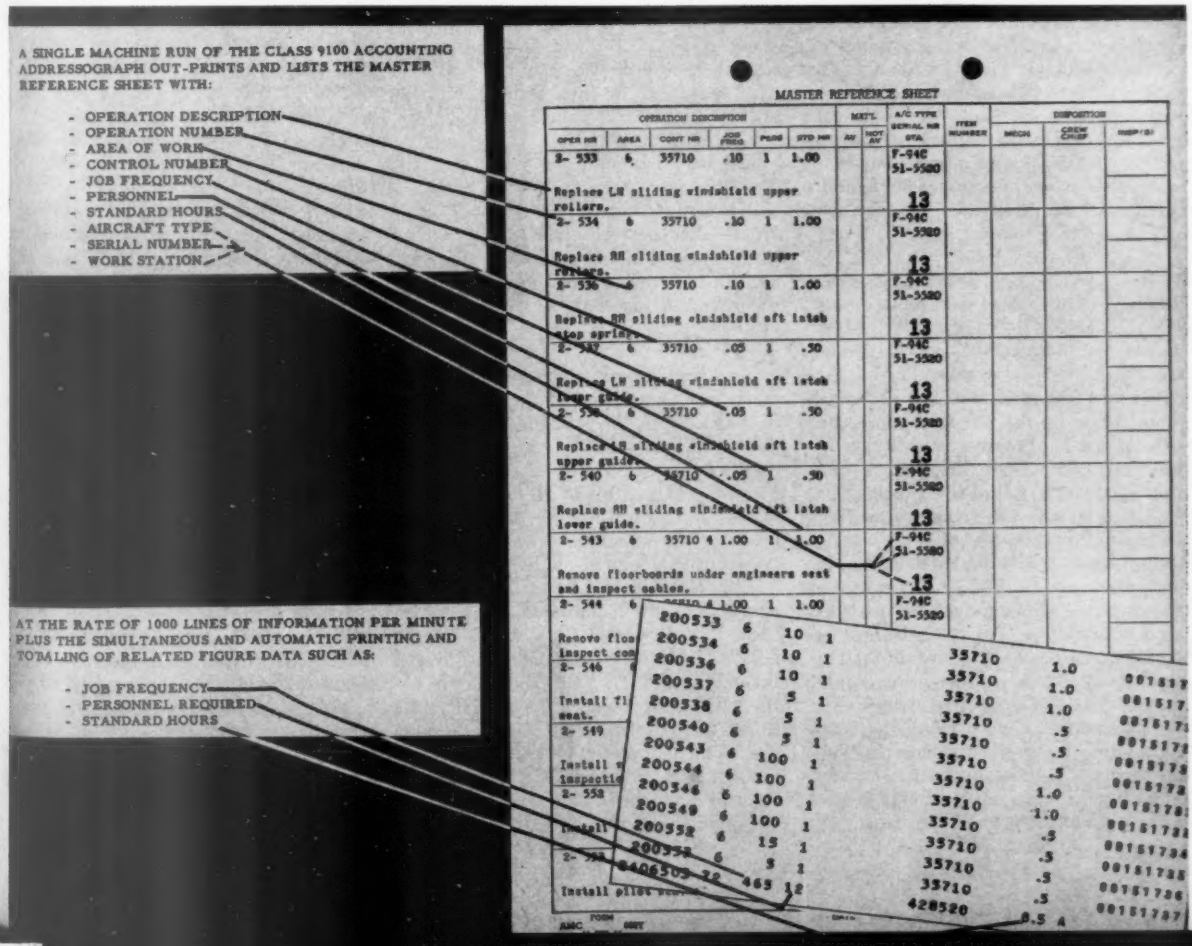
How the System Works

Use of the data plate files starts with the receipt of notification from a using command or activity that, in accordance with the predetermined time-phased schedule, aircraft serial No. X, type B, Model 47, series C, is being dispatched to the repair point designated. This is the signal for action as follows:

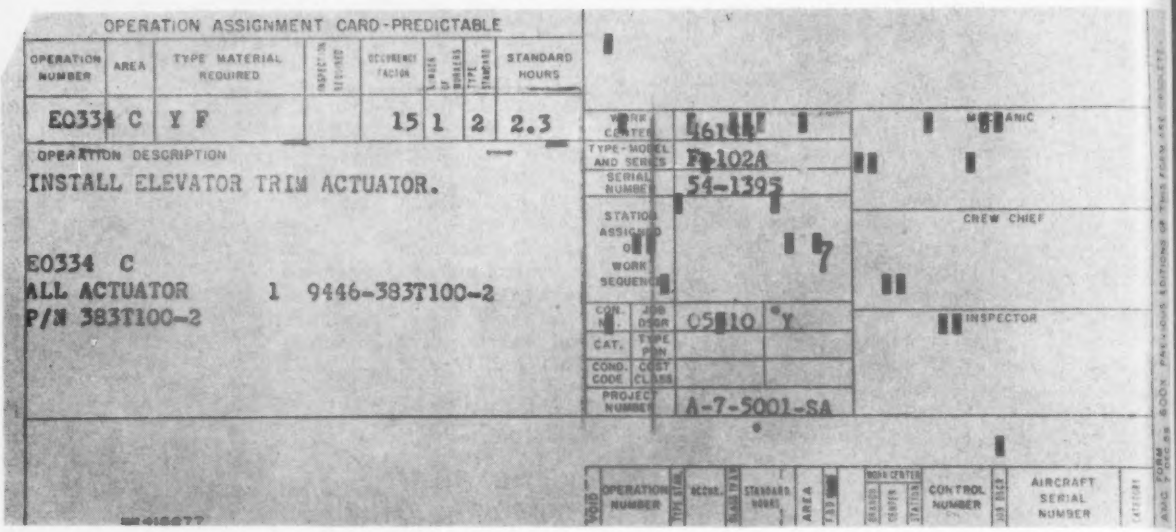
Step One:

Production Control receives information and advises Inspection, the Aircraft Repair Branch Supervisor, and the machine room of the Aircraft Control

Fig. 3—Master Reference Sheet in In Progress and Final Inspection Work Book lists all predictable operations, includes space for production recording and inspection dispositions.


A SINGLE MACHINE RUN OF THE CLASS 9100 ACCOUNTING ADDRESSOGRAPH OUT-PRINTS AND LISTS THE MASTER REFERENCE SHEET WITH:
- OPERATION DESCRIPTION
- OPERATION NUMBER
- AREA OF WORK
- CONTROL NUMBER
- JOB FREQUENCY
- PERSONNEL
- STANDARD HOURS
- AIRCRAFT TYPE
- SERIAL NUMBER
- WORK STATION
AT THE RATE OF 1000 LINES OF INFORMATION PER MINUTE PLUS THE SIMULTANEOUS AND AUTOMATIC PRINTING AND TOTALING OF RELATED FIGURE DATA SUCH AS:
- JOB FREQUENCY
- PERSONNEL REQUIRED
- STANDARD HOURS
MASTER REFERENCE SHEET
OPERATION DESCRIPTION
MAT'L
A/C TYPE SERIAL NR STA
ITEM NUMBER
DISPOSITION
OPER NR
AREA
CONT NR
JOB FREQ
PERS
STD NR
AV
NOT AV
MECH
CREW CHIEF
2- 533 6 35710 .10 1 1.00 F-94C 51-5580 13 Replace LH sliding windshield upper rollers.
2- 534 6 35710 .10 1 1.00 F-94C 51-5580 13 Replace RH sliding windshield upper rollers.
2- 536 6 35710 .10 1 1.00 F-94C 51-5580 13 Replace RH sliding windshield aft latch stop spring.
2- 537 6 35710 .05 1 .50 F-94C 51-5580 13 Replace LH sliding windshield aft latch lower guide.
2- 538 6 35710 .05 1 .50 F-94C 51-5580 13 Replace LH sliding windshield aft latch upper guide.
2- 540 6 35710 .05 1 .50 F-94C 51-5580 13 Replace RH sliding windshield aft latch lower guide.
2- 543 6 35710 4 1.00 1 1.00 F-94C 51-5580 13 Remove floorboards under engineers seat and inspect cables.
2- 544 6 35710 4 1.00 1 1.00 F-94C 51-5580
200533 6 10 1 35710 1.0
200534 6 10 1 35710 1.0
200536 6 10 1 35710 1.0
200537 6 5 1 35710 .5
200538 6 5 1 35710 .5
200540 6 5 1 35710 .5
200543 6 100 1 35710 1.0
200544 6 100 1 35710 1.0
200546 6 100 1 35710 1.0
200549 6 100 1 35710 .5
200552 6 15 1 35710 .5
200553 6 5 1 35710 .5
8406503 28 463 12 428520 .5 A

XUM


OPERATION ASSIGNMENT CARD - PREDICTABLE

OPERATION NUMBER	AREA	TYPE MATERIAL REQUIRED	INSPECTION REQUIRED	OCCURRENCE FACTOR	NUMBER OF MECHANICS	TYPE STANDARD	STANDARD HOURS
E0334	C	Y F		15	1	2	2.3

OPERATION DESCRIPTION

INSTALL ELEVATOR TRIM ACTUATOR.

E0334 C
ALL ACTUATOR 1 9446-383T100-2
P/N 383T100-2

WORK CENTER 461
TYPE - MODEL AND SERIES F-102A
SERIAL NUMBER 54-1395
STATION ASSIGNED OR WORK SEQUENCE 17
CON. NO. JOB ORDER 05110 Y
CAT. TYPE PDN
COND. CODE COST CLASS
PROJECT NUMBER A-7-5001-SA

MECHANIC
CREW CHIEF
INSPECTOR

OPERATION NUMBER | WORK CENTER | CONTROL NUMBER | AIRCRAFT SERIAL NUMBER

AMC FORM 600X PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

Fig. 4—Operation Assignment Card depicts both the printed work instructions and punched data.

Branch of the estimated aircraft arrival time and the aircraft identity. The machine room pulls the files of plates applicable to that type and model of aircraft, places the plates in a printer, and prints out an "Inspection Guide" to be used by examination and inventory personnel in performing the shakedown inspection on the incoming aircraft. This operation is followed by printing a Consolidated Work Book, which is a series of pages listing all the possible predictable operations to be performed on a specific aircraft. The listing also contains the examination and inventory codings and applicable technical orders. Actual aircraft inspection then follows the inspection guide, applicable work operations being indicated on the Consolidated Work Sheets.

Step Two:

The Consolidated Work Sheets are returned to the machine room (mechanized scheduling unit). Those operations indicated to be performed are pulled from the plate file by machine selection. The selected plates are then placed on the printer for preparation of an In Progress and Final Inspection Work Book. This book consists of Master Reference Sheets (fig. 3) listing all the predictable operations authorized by inspection for work accomplishment, and includes space for production recording and inspection dispositions. The same plates are then used to prepare a deck of Operation Assignment Cards, AMC Form 600X. This card (fig. 4) includes printed and punched data. The printed data is used by Production Control and the shop supervisors for work assignment, work instructions, and production recording. The punched data is used by Statistical Services Division and the Cost Accounting Division in the electrical accounting machine preparation of the earned hour (effectiveness) reports, cost reports, material transaction requisitions, production reports and other management data. Each 600X card is a duplicate of one of the predictable operations listed in the In Progress and Final Inspection Work Book. A third operation is then performed, with the same plates used for the work deck and work book making up a "recap" sheet. This recap sheet is an accounting machine tape listing of the predictable operations by their coded numbers and standard work hours. It also shows totals for both operations and standard hours by work center or work station. The complete package—a deck of work assignment cards, a work book, and recap sheets—are given to Production Control for scheduling, assignment of skills to work center, and obtaining the required material.

Step Three:

The predictable work assignment cards are then placed in the work centers, docks, or stations, as applicable. As the work is completed, the card applicable to the operation performed is signed off by the worker and turned in, indicating the actual hours used. At the same time, the same work book entry is signed off by Inspection. These functions continue until all operations are completed, all cards turned in, the total job and the work book completed. The completed work book becomes an historical record of the work performed on the aircraft and is retained in the Inspection Division files. The completed operation assignment cards first provide Production Control a record of the progress of work; second, give actual hours as a comparison against the standard; third, provide the source data for production counting and the Earned Hour Report of effectiveness. Other advantages, such as the ability to quickly locate poor workmanship and correct deficiencies, are evident.

Many advantages are gained by the application of mechanized equipment to this system: printing reproduction speed, ability to write clear instructions to the worker, and a variety of data produceable from the combination plate assembly. The greatest potential of this system is its capability to meet emergency situations.

This AMC system can, in a matter of a few hours, readjust the work requirements for every aircraft in work in our depots. By quickly reviewing the master plate files, those minimum operations can be selected which will make the inwork aircraft ready in the shortest time to safely accomplish its mission. The revised card decks, work books, and recap sheets containing the new work requirements will be rapidly reproduced for the shops. The ability to compress work requirements without wasting time or disrupting routines, and the elimination of all confusion in a time of emergency are of paramount importance. These outstanding features are probably overlooked in the evaluation of the obvious peacetime advantages—manpower conservation and economy of operations.

The aircraft control system is the only phase of the Air Force repair program utilizing this equipment at the present time. The economies attained plus the simplification of procedures dictate the necessity for application of electromechanical equipment to every facet of operations where adequate research proves such a step practical.

Are the Services Really Training Managers?

The Services have many outstanding managers—but it may not be the result of a superior formal education program.

by Robert Allen

It should be noted that the author has taken the liberty to generalize in those areas requiring attention. Progress has been made and is being made in each area discussed below, but his point is that there must be a great deal more.

THE Army educational system has grown with leaps and bounds since World War II. Courses are being offered in almost every conceivable area. Career courses, for both regular and reserve officers (basic, company and advanced officers), are usually offered by the branch service school. In addition, a wide variety of specialists courses are offered at the branch schools and elsewhere; and beyond the branch service-school level are the Command and General Staff College, the Armed Forces Staff College, the Industrial College of the Armed Forces and the Army War College.

A recent, potentially great, addition to the system is the Army Logistics Management Center, which offers managerial specialist courses in such fields as procurement, requirements, storage and distribution, property disposal and maintenance as well as an executive "supply managers" course.

In a sense, the objective of all officer courses is the development of "the manager."

"General" *vs.* Specialist

With this comprehensive program of education available to officers, it would appear that the Army is more than meeting its training obligation. However, there are a number of factors operating which complicate the training picture. One is the traditional philosophy of officer education which translates itself into a personnel problem. I refer to the educational philosophy of developing the ideal, the "all round" commander—the supervisor who is to be competent in all areas in order to command intelligently.

There are those who feel that all officers should be trained to ultimately become Chief of Staff, a commanding general, chief of a Technical Service, and the like. They further interpret that objective to mean that he must know "everything about everything"—a task far beyond the capabilities of mortal man. They envision a man who can chat intelligently on the subject of nuclear physics, switch easily and quickly to the procurement of refrigerated warehouses, argue with conviction that General Lee's tactics at Gettysburg showed poor insight, and then perhaps discuss pro and con the sex life of the Smang tribe of pygmy negroes of interior Malaya with a charming companion at a supper buffet.

It is assumed that a variety of assignments will inevitably bring this about. Certainly, varied assignments will broaden the officer, but there are not sufficient assignments to qualify him as an expert in every major field of military endeavor.

In this new era of technological development some men will be needed as very narrow career specialists, while others will be tagged for general command positions. All should have the opportunity for general officer rank both as specialists and commanders. *The Specialist needs status and prestige.*

The current philosophy of the "general" *vs.* the specialist in terms of promotional opportunities plagues the personnel officer who slaves to identify and develop talent in our officer ranks. Too many officers with real skill and interest in a specialist field are afraid to have too many assignments in that field—are afraid to be "labeled" for fear of lack of promotional opportunity after reaching the rank of lieutenant colonel. Thus, well-trained and interested men strive for personnel assignments in fields other than their real interest, creating twice the original training problem. Not only do they need to be trained in new areas, but also someone else must be trained to move into their specialty field.

Logistical Complexity

Modern warfare has become too complex for the philosophy of the "all round" officer having priority over the "specialist." The day of the supply train, forage and the like is gone forever. We live in a jet age, requiring automation and instantaneous supply support. To do this requires the same aproach to specialist training as we might have for our pilots, our engineers, and our maintenance personnel. Each of the great logistical areas—requirements, procurement, storage and distribution, stock control, maintenance

About the Author

Dr. Allen is the Educational Adviser to the Quartermaster Training Command and The Quartermaster School, Fort Lee, Va. He is a recipient of the Decoration for Exceptional Civilian Service from the Secretary of the Army. He was recently awarded the Secretary of the Army Research and Study Fellowship to study the application of televison to training. A former university professor, he has been in military education for 10 years. He served with the U.S. Navy during World War II in the Pacific and is currently active in the Naval Reserve.

Author Allen Says In Brief:

1. We must give the officer specialist status and rank to encourage career ambitions based on native talent.

2. We must distinguish between training a supervisor and training a technician.

3. We must make supervisors out of our officers (and technicians out of our enlisted men).

4. We must simplify our managerial and clerical processes and procedures so that they are very easily mastered by any NCO or commissioned officer; so that a man with *less* than average intelligence can understand it easily. We must develop equipment and material easily maintained and repaired by men with a low level of intelligence.

5. We must not institute new managerial techniques and tools until we have trained personnel available to effect successful establishment. The Army Command Management Program is excellent; it breaks down upon execution because of the lack of knowledgable personnel.

6. We must have fewer schools and courses and capitalize to a greater extent on on-the-job training for individual and supervisory development; we should further streamline our school training for officers.

7. We must improve upon our personnel selection and assignment; graduates must be assigned immediately into their areas of qualification; we must seek a program that will permit fewer faculty members, fewer students and more men on the job. Classification and selection procedures must be improved all the way back to the original draft of enlisted men or procurement of officers.

and salvage—requires leadership under skilled specialists. Separate areas such as POL, food service, aerial supply, etc. (to use Quartermaster examples) will call for specialists, too.

The complications of this system are creating the need for more and more schools and draining our limited supply of operating manpower. The schools must be manned by both a faculty and a student body. Before World War II, the services were, in a sense, training over 90 per cent of the time on-the-job. Every service agency was more or less in the training business. Today, the formal-type school must perform much of this training responsibility. We have, in addition, operating personnel responsibilities all over the world. Our nation's defense commitments are large; our personnel supply is limited. Managerial trends seem to call not only for larger staffs but also more and more schools or courses in which to train personnel, which in turn drain off too much of our potential operating force. Despite our management engineering work-simplification and personnel surveys, staffs seem to grow in disproportion to the workload.

Chain Reaction

There is a chain reaction stemming out of the complexity of modern-day logistical doctrine and procedures. It runs something like this:

a. This is new and complex—we need more individuals trained in this area—so we must

b. set up new schools and/or new courses of instruction, which in turn

c. requires a faculty—or a faculty increase and a student body—which

d. means establishing an organizational requirement for personnel on the faculty and quotas of students—which

e. forces personnel officers to "requisition" prospective officer students—in some cases regardless of talent or job assignment—upon graduation, which

f. leaves fewer officers for operating assignments leading to

g. malassignment upon graduation because quotas in the schools cannot be accurately determined.

This tendency to add schools and courses could jeopardize the entire personnel and training program! Once a school is established, it must have students and it naturally desires to grow. Just as a two-year civilian college desires to become a four-year college granting diplomas, so any service school moves in the direction of more rather than fewer courses. Quotas are developed and must be filled to keep the school in operation. Filling quotas does not always mean sending students who are qualified and who will necessarily be assigned to the study area upon graduation. All too often officer and enlisted students may be trained in one field and assigned to another due to the changing needs and requirements of the moment.

More Schools, Courses, Details

The top supervisor in many cases is overwhelmed with details. He can't possibly digest the mass of information contained in the typical "short" course, and if he does develop keen interest and understanding, in some instances, he becomes a technician rather than a supervisor.

An excellent example of how our training objectives have become more difficult to translate is the Army Command Management Program.

Instead of simplifying our managerial and comptroller principles and procedures, we keep making them more complex—forcing the creation of new schools and/or more courses.

One reason why the supervisor has become more interested in the technical details than in his true supervisory responsibility has been the tremendous surge of supermanagerialism. The age of the management engineer—and the comptroller—is here. The tide has long since swept past the bounds of practicality for many supervisors. The certified accountants and their relatives, the management experts, have "snowed" the poor supervisor with programs, budgets, surveys and the like. The supervisor has a choice of attempting to halfway understand the command management programs through concentrated study of details or being forever dependent upon some bright young subordinate, military or civilian.

The Management (Engineering) Division and the overall Comptroller organization were created as additional staff service agencies. Management engineers *can* contribute greatly to the success of an organization, if they remain an *aid* to the commander in his assigned mission. But the control oftentimes no longer lies in the hands of the commander. He must ask whether he can do this or that. We have created an administrative monster that may engulf us yet.

We cannot successfully place into effect managerial techniques and tools without having trained and capable men at all echelons. There is a profound lack of respect among many top managers for the very managerial tools charged to them for execution. This respect could be gained through understanding, if the procedures were truly *practical* in both peace and war.

The Big "Lag"

Complicating our training picture, also, is the current surge of new ideas, concepts, and procedures proposed for the new Army in the "atomic age."

New logistical materials and procedures must be developed to support constantly changing strategy and tactics. Yet doctrinal changes in the combat arms will take a year or more before they become available in the right amount and in available publications for logistical instructors and supervisors. It is difficult, if not impossible, to teach an up-to-date program of instruction with the rapid change in terminology, organization, principles and procedures occurring almost daily. We cannot and should not stem the tide of progress, still we must take steps to incorporate to the maximum the "new thinking" within each and every course of instruction. To do this requires that fewer picayunish and more *significant* changes be adopted;[1] that the search for improvement in principles and methods emphasizes the *simple* and easily accomplished (for example, equipment a moron can maintain and a below-average-intelligence soldier can repair!). There are far too many changes which serve to confuse rather than to improve.

It means also that the vast research efforts and revisions in training publications common to two or more services should be coordinated more effectively.

Research Service Needed

An abstract service should be available to the faculties of all Service schools. New means of providing information for organizations and procedures should be explored in view of the time required at present to draft, approve, and publish technical manuals and bulletins. Researchers of all governmental agencies should be able to go to a central source (perhaps IBM-operated) to obtain what has been done and is being done in special areas. This will avoid duplication of effort, save time and equipment.

In addition to changes occurring within the purely logistics field, there are wholesale revisions potentially possible in the logistical application of new strategy and tactics. To incorporate and apply these changes quickly requires a different approach in the development of publications, films, and supporting instructional materials. For example, films should be produced in a matter of days rather than years; publication methods, procedures and final products might well be revamped completely.

[1] Changing titles and labels, organizational changes without functional impact, etc.

Back to On-the-job Training

It is not possible for the formal schools to take care of all instructional needs. The return to on-the-job (or in-service) training programs and seminars will be a partial answer; also helpful would be the ability of each individual officer logistician to study and to teach himself. The latter is the true student. Supervisors can learn on-the-job.

(*You can go to school enough to miss an education!*) Because we have a tendency to complicate our operational procedures and principles, schools are becoming more and more popular. However, in our eagerness to train supervisors and managers, we have bowed at the fountain of formal education and may not have taken advantage of our on-the-job experience and training opportunities. During the hustle and bustle of the everyday routine, supervisors do not have the time anymore, seemingly, to plan programs for on-the-job development of their subordinates. The Service schools and special schools, at home and abroad, have been used as an answer to the problem of supervisory development—a problem created in part from the shunting of supervisory interest and attention to lesser details. The development of managers through on-the-job training, through such methods as "Multiple Management,"[2] Supervisor-Alternate System, and the like, has lagged.

There are two additional points that might be mentioned since time does not permit full discussion:

1. We must integrate the training managers within our career courses and consider *consolidating* managerial-logistical courses being presented in many different locations. It follows also that the Department of Defense must consolidate not only functional common services but training—crossing all services. (A school such as the Army Logistics Management Center is a star on the horizon because it cuts across all technical and administrative services.)

2. In our programs of instruction for career officers, we might consider the importance of emphasizing communicative skills and encouraging creative and independent problem-solving. We must value these fundamental skills along with those of a technical nature.

Wrap Up

We *are* training managers. The Army need not tip its managerial hat to any other sister service or even to private industry. Despite its established high level of achievement, there is still much to be done.

You can never separate training and personnel management. The integration of revised personnel selection and assignment policies and procedures with a minimum formal training program and a maximum on-the-job training program will lead to greater economy to the taxpayer and a higher degree of efficiency and support of our defense forces. Remember, *Selection* and *Assignment* are the most important aspects of a successful training program.

This article has dealt with but a portion of the problem. There is much to be done also in the selection and training of enlisted technicians and basic tradesmen if we are to save time, money, and materiel upon mobilization. We can no longer select from draftees given to us locally. We will have to push selection and training right back into the local communities. Then we can take what we need by occupation and aptitude.

There is too much classification, selection and training for administrative convenience. We are wasting talent and interest. Let's become creative in the business of personnel and training.

[2] Plan established by the McCormick Company, Baltimore, Maryland, whereby junior executives, factory foremen, and salesmen may be selected for three major supplemental boards.

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Personnel Preview

■ **A second training cycle** will start at **Ft. Belvoir, Va.**, about **February 10** on the Army Package Power Reactor (or APPR-1).

The **Corps of Engineers** has selected 25 enlisted men to attend the course and each of the other Army Technical Services have been invited to send men to participate. The **Air Force** and the **Navy** will send one officer and three enlisted men each to participate in the training course. The trainees will receive six months of academic training and six months of operational training at Belvoir. This second group of trainees will provide a crew for the Ft. Greely plant (see **Logistics**).

■ **Lockheed recently** invited high school seniors across the nation to compete for a virtually expense-free college education in the fields of air and space science, engineering and technology.

Through letters mailed to principals and counselors of more than 10,000 public, private, and parochial high schools from coast to coast, the Lockheed Leadership Fund outlined details of 15 four-year scholarships. Each scholarship has a four-year value of approximately **$7500.**

■ **The Navy** will convert 500 sailors and marines a year into science-trained officers, **Navy Secretary Thomas S. Gates, Jr.**, announced recently.

Starting next year, enlisted men will be enrolled in civilian colleges and universities in four-year courses leading to science degrees and Navy commissions. Part of an effort to boost the supply of scientifically trained officer personnel, the **Navy program** marks a departure in military education. **Army** and **Air Force** science programs are designed primarily to recruit men already holding commissions.

■ **Commanding Generals** of the **Marine Corps Air Stations** at Cherry Point, N. C. and El Toro, Calif., have new titles as a result of a recent order.

The newly designated commands are: (1) Commanding General, Marine Corps Air Bases, Eastern Area, with additional duty as Commanding General, Marine Corps Air Station, Cherry Point, N. C., and (2) Commanding General Marine Corps Air Bases, Western Area, with additional duty as Commanding General, Marine Corps Air Station, El Toro, Calif.

■ **The RAND Corp.** of Santa Monica, Calif., announced recently that negotiations have been completed with the U.S. Air Force for the transfer from RAND to the newly formed **Sperry Development Corporation** of a $20-million contract to provide professional technical services to the **Air Defense Command.**

The new corporation grew from the System Development division of RAND, a scientific advisory organization engaged in long-range research principally for the **Air Force.** The SDC is working on two major projects. The first is the development, installation and maintenance of a **System Training Program** for the air defense system, designed to help personnel of the ADC develop increased flexibility for meeting any emergency. The second is that of programming for the computers in the Semi-Automatic Ground Environment (SAGE) air defense system. Programming is a comparatively new technical field in which persons trained in logic and mathematics prepare problems for solution by modern computing machines.

■ **The Army** will conduct a nine-month formal training course in nuclear medicine for Regular Army officers.

Beginning July 1, 1958, the course is sponsored by the **Armed Forces Special Weapons** project.

■ **The new Military Pay Voucher** system for officers and enlisted personnel will become the **Army** way of paying on July 1, 1958, if the Defense Department, General Accounting Office, and Bureau of the Budget approve.

Recently approved by the **Secretary of the Army,** the new system is based on a monthly voucher which shows all the money an individual has coming and all the deductions taken from his pay. He has a complete accounting of his pay each month and can catch any errors that appear. Under the new MPV system, there is less chance for error resulting in overpayments or underpayments, the Army said.

■ **Under a standardizing program,** the **Air Force** has begun slanting technical manuals on ballistic missiles towards the personnel using them, rather than towards the equipment being used, and reducing format of the manuals.

"The job-orientated concept is considered by the armed services to be a necessary refinement and extension of other recent developments in technical manual policy, and is the result of the need for increased specialization," said **D. R. McDowell,** manager, Technical Services, Guided Missile Research division, the **Ramo-Wooldridge Corp.**

How Three New Ideas Reduced Supply Issue Time

Today any of the 135,000 items in stock on the shelves of the main Supply Department stocks can be put in the hands of the journeyman shop worker the same day that he requests it—not on a limited walk-through emergency basis—but as a routine matter.

by Captain F. D. Witzel
Supply Officer
San Francisco Naval Shipyard

A NAVAL SHIPYARD is a gigantic collection of job shops. The integration of its operations is a challenge, a stimulation to new thinking and to new ideas. The overhaul and repair of ships is a tremendously complex task. For each vessel, as it comes to the shipyard, work is broken down into hundreds of job orders, each of which is scheduled through at least one and, more often than not, several of the 16 Production Department shops.

Planning and production control require the hands and the brains of many people—a large naval architectural and design group, dozens of planners and estimators, and a hundred or more production schedulers and expediters. All these are required to insure the optimum use of men, tools, and material. The time of each of the thousands of journeymen, and use of machine tools must be fitted into a schedule for each day.

Lack of material, of course, will interrupt the smooth flow of this work. A workman on the bench who has just taken apart a large fuel pump for inspection and overhaul does not want a long delay in obtaining the necessary repair parts from the Supply Department. He feels, and rightly so, that he is entitled to at least as good service as would be given by a commercial auto repair part supply company to an independent garage.

Under presently authorized procedures only a small number of emergency issues can be handled on one-day delivery. This system does not always satisfy the workman or the journeyman on the bench awaiting delivery of a badly wanted part.

In the San Francisco Naval Shipyard a major change in its Supply Department operations has been effected.

The shops' and planners' demand-requests for material number 500 to 1500 per day. Each of these can now be delivered to a production or public works shop from the main Supply Department stocks no later than the following noon. A procedure has been established for local customers so that all issues can be made in one working day if the material is available in stock.

This new change has been applied also to the demand requests placed upon the Supply Department by the tenant activities within the San Francisco Shipyard, such as the Naval Radiological Defense Laboratory and ships of the Pacific Reserve Fleet. It also applies to demand requests made by the Assistant Industrial Manager for material to be furnished for the repair of U.S. naval vessels at San Francisco Bay Area commercial shipyards.

(It should be noted that this new routine does not supplant the shop stores operation, which still gives service to the Productive and Public Works Department shops in issuing standard stock in small quantities, generally less than the normal unit of issue.)

How was this revolution accomplished? By taking advantage of and combining three ideas: (a) popularity storage, (b) the post-posting of stock records, and (c) a fast shipyard delivery system.

1—Popularity Storage

The idea of popularity storage has been promoted in the Navy by the Bureau of Supplies and Accounts for several years. The attack in the San Francisco Naval Shipyard was two-pronged. First, an analysis was made of all the material on hand by size and weight, frequency of individual issue, and quantity of individual issue. Second, from this analysis an optimum stock location plan was set up and stock moved to new locations.

This analysis brought some illuminating results. First, it was discovered that over three-fourths of all the items on hand could be stored in bins. Second, it was found that over 80 per cent of the demand requests from the planners and the journeyman mechanics applied to those binnable items. The conclusion was fairly obvious: put all such items in the shipyard in one central location; set up a gigantic consolidated bin storage.

A large open space on the second deck of the principal Supply Department building was chosen. This space is alongside the main office area, directly over the Delivery Section of the Traffic Branch. A working stock of more than 108,000 binned items has been placed there. Because of their extremely small size, 80,000 of these 108,000 items have been placed in the bins.

The issuing procedure is as follows: Incoming stub demand requests are sorted and marked by warehouse and bin location by personnel operating a single Supply Department master bin and warehouse locator file. This Master Stock Locator File is situated outside the main entrance to the Consolidated Bin Storage Area.

In making issues from the Consolidated Bin Storage Area, a warehouseman takes the request document and, pushing a cart up and down the aisles, picks each item out of stock in the order of its location number. He puts each item into a polyethylene bag and inserts a copy of the consignee's demand stub. This copy is easily read through the side of the bag. The bags are put in an elevator, which drops to the Delivery Section located on the first deck below. Within two hours the bagged item is on its way to a Production Shop. Loss of time in assembling binned items from a large number of scattered warehouses has been eliminated. Items are already consolidated for delivery at the point of issue.

If the item is to be sent off the Shipyard, it moves to the Parcel Post Packing Shop, also located in this area. There the item is packed, labeled, and put in the mail the same day the expenditure invoice is prepared.

For larger items of stock stored in warehouses, the stub demand request with its warehause location marked upon it is forwarded to the appropriate warehouse by hourly messenger service. The stockman breaks out the item for issue, and it is picked up by the next round of the Shipyard delivery truck system.

The popularity storage program has saved several days in making issues.

(The scheduled time for making routine issues out of the Consolidated Bin Storage Area to the Delivery Section is four working hours.) The elimination of mail handling and messenger traffic between scattered buildings has produced a savings of this magnitude.

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2—Post-Posting

About the time the popularity storage program was begun, Bureau of Supplies and Accounts changed the instructions authorizing post-posting of stock status records in certain situations. On 2 July 1956, the Shipyard Supply Department shifted its record-keeping procedure to the post-posting method—recording on the stock records the issue of material on demand stubs, DD Form 1150 (Request for Issue or Turn-in). (Issues made on shipment requests and shipment orders from U.S. Navy supply demand control points are not post-posted to the stock records. They are still being pre-posted.)

Now that the stock control clerks are no longer under the pressure of holding up routine issues while they transact emergency business, they are better able to schedule their daily work. Greater individual production in the Stock Control Branch has resulted since all hands work on a planned basis.

Most important—a three or four day saving in issue time for routine issues has resulted.

Many other dividends from this change have been experienced:

a. Reduction in the number of required adjustments on stock and financial records when issues are made from the main Supply Department stocks. These adjustments were necessary in the categories of material not issued in predetermined quantities, such as lumber, steel, rope, cable, etc. Under the old method a debit or credit adjustment transaction was almost always necessary to bring the pre-posted issue entry into agreement with the actual amount issued.

b. Elimination of the large number of "walk-through' 'requisitions in the Control Division.

c. Automatic purification of stock records because of the double check, both at the warehouse and the Stock Control Branch, of stock availability. This has cut down unnecessary small procurements. It will also result in a significant reduction of differences at inventory-taking periods.

d. More rapid and more accurate reflection of a "not-in-stock" condition in the warehouse.

3—Delivery Speed-up

The changes discussed above have produced a speed-up in shipyard delivery. The Supply Department Delivery Section had long handled all items (from a one ounce fire-control part in a paper bag to a 25-ton delivery of sacked cement) on pallets lifted by fork trucks. A little thought to this problem made it obvious that the binnable items being sent out in polyethylene bags could be moved more efficiently in a seabag pick-up-truck delivery system.

Under the new procedure, the bagged items are sorted by shops and offices into separate canvas bags. These are placed in a pick-up truck and dropped off at each shop on a two-hour schedule. Materials too large to be worked through the canvas-bag procedure are still delivered on pallets by open trucks, also on a two-hour schedule. This change in delivery procedure has saved a day in the total time required to make issues from the Supply Department.

In-transit material losses have been reduced, and documents—formerly attached to open loads lying on truck trailers—have been better protected.

Benefits

The effect on the Shipyard Planning Department of this faster issue time has been important. Greater adaptability to impending design changes and alterations to customers' orders is allowed designers, planners, and estimators.

The impact on the Production Shops has been impressive. A high degree of flexibility in job scheduling has been introduced through fast availability of materials. Emergency walk-through stubs have been reduced in number because all issues are now handled at a speed formerly given only to emergencies.

The three parts in the new system of making fast issues have not been in effect long enough to make an accurate determination of savings in personnel, but a significant saving is expected.

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Your Investment Future

WHERE WILL THE STOCK MARKET GO FROM HERE?

by W. Mac Stewart

Vice-President, Research, Hamilton Management Corporation

DO YOU recognize these quotations?

"Enough damage has been done to investor confidence that it will be some time before the market resumes its upward trend."

"Prices are seeking a new level that will be more in conformity with the economic facts."

"The market must now revise its estimates of the profits which industry as a whole may be expected to make in the future."

They could have come from a periodical published yesterday, last week, or two months ago. But they didn't. They were written in *September, 1946*—11 years ago!

This should serve as a lesson to alarmists who are now asking, "How far is the market going down?" "What caused it?" "Should I sell out now and buy back later?" All this concern is caused by the fact that from its mid-summer highs, the stock market declined about 20% to lows reached in October. Many uninformed investors have viewed this drop of stock prices with feelings ranging from mild anxiety to strong apprehension. In such times, emotionalism takes over and logic goes out the window, particularly as paper losses accumulate.

Is this something new? Let's turn back the pages of history for a moment and see. In the Spring of 1942 market levels were really low—some 80 percent below recent highs. From that point market levels *increased* more than fourfold to reach the highs of Spring, 1956—14 years later. Was this a steady rise? Certainly not. During this gradual rise the market experienced many drops of from 10% to 25%—some greater than the current decline. Obviously, then, when viewed in the light of past years, the recent 20% decline is hardly earth-shaking.

Where is the market going from here? Perhaps another review of history may provide an answer. Let's turn back even further into the pages of market history and look at another 14-year period: 1932 to 1946. Just as in the first example, during this 14-year period the market staged an advance of more than 400%. And, like the 1942-1956 era, the advance featured several declines of 10% to almost 50%. Then, shortly after August, 1946, in the short time of *one month*, the market dropped 20%. (Note: The recent 20% decline required three months.)

What happened next . . . did the market continue dropping? While investors were still viewing the trend with apprehension, the market recovered somewhat, and over the following 36 months never dropped significantly below the levels reached in 1946. Then the strong upward trend of market prices reasserted itself, and by April of 1950 the market was again back to the levels of mid-1946. From that point the market staged a long-term advance that averaged 20% a year for the next five years, and then went up another 25% to its highs in 1956.

So you see that the recent decline to October lows is no different than many others that have occurred through the years. Confidence is always shaken when the market declines, because many investors think only of this week, next month, or the end of the year. They lose sight of the economic development of this nation over the years. Had investors in 1946 looked to the 1950's, their fears would have faded, and faith in their country's future would have been amply rewarded.

What's ahead for us as investors? Again, if we wish to learn from history, we should look toward the early 1960s when, if precedent is any criterion, stock prices should be *twice* what they are now. Long-term holders of sound common stocks or common stock investment media should again reap the benefits of faith and patience.

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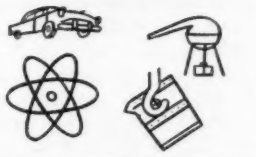

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Ten Commandments For Dealing With the Press

by Lt. Col. Carroll V. Glines, USAF

"Why, those news wolves even wanted to know why I had never graduated from college and didn't I think being in charge of 2,000 people was a job for a man with a little more age, experience and education. Ye Gods, don't those people know anything about the services?"

EVEN though the military has an important job to do, it can't take itself for granted. It must take time out to explain its job occasionally because it has an obligation to tell its story to the American public. That obligation rests with all those in uniform but it is the *special* responsibility of the military's leaders to tell the story by using all the informational media made available to them. This is a serious responsibility—so serious that it deserves much more thought than is generally conceded.

Although it is a truism that "rules are made to be broken," it is quite possible that there are some basic rules or maxims that can be used by all military men when they are confronted with the problems of dealing with the press. The following Ten Commandments have been found useful by some to keep themselves on the straight and narrow and out of trouble with their severest judges—the gentlemen of the press. Perhaps they will work for you.

I. Thou Shalt Cooperate With Thy Press, For Truly They Art the Voice of Thy People.

In our form of government the military man derives his office, his prestige and his power from the opinions and desires of the people he protects. These opinions and desires are made known through the spoken and written word. Thus, our "press" reflects the happenings and doings of all—if it might be of interest to readers and listeners.

But the press can never reflect what *actually* happened if it doesn't get *all* the facts. Editors don't want half a story. Reporters are only human, and if they only have "half a story" and can't get the other half because someone won't give it to them, it is only natural that the unknown half may be "slanted" or even downright fabricated.

But can't this business of cooperating with the press go too far? Maybe. But you don't have to go very far to be cooperative with the press. They want to be able to call a military installation and get someone on the horn who can give them the facts and answer their questions without getting the "brush-off" treatment. They want to be invited to press interviews where there is *real* news to be given out, and they like to get regular routine news releases from the base information office without asking for it. They want pictures occasionally. They want man-to-man interviews with the people who make news even if it is bad news. And sometimes they want material for editorials for readers who want independent views and sidelights on the news. All these things *can* be provided with "no sweat" on the part of any commander, if he doesn't fight the problem and realizes that cooperation will pay dividends in the end.

Maybe cooperation *can* go too far, but generally it doesn't go far enough. Many a man in uniform fails to recognize the power of the American press and thus fails to understand that his future in uniform may easily hang on his attitude toward the press.

About the Author

Present position: Chief, Educational Methods Division, Air Command and Staff College, Maxwell Air Force Base, Alabama.

Previous military experience: Served four years as Assistant Professor of Air Science at the University of Oklahoma (1950-1954). Was Operations Officer of 2592d Air Reserve Training Center for 1½ years (1949-1950). Overseas service spent in Germany and Panama (1946-1949). During WW II was a flying instructor in Training Command. Commissioned originally on January 2, 1942 at Victoria, Texas.

Author Comments

If you are a member of one of the services, you may be one of those who would take violent issue with the viewpoint presented here. I would be the first to say that it doesn't seem fair that the uniformed services must submit to the whims and fancies of the American press. I would agree with your logic when you said that *everyone* should have the right to fight back when he has been wronged or tricked or misquoted. However, I would ask that you look at the other side for a moment and reflect on why we have armed forces. I would remind you that another great nation has an armed force which has the power and the will to annihilate ours if we let it. And I would try to point out that, of all the differences that exist between our way of life and the other, the single most important one is the right of our press to print what it wants—even if it's wrong.

II. Thou Shalt Not Steal the Public Eye Without a Saintly Purpose Lest All the World Forsake Thee.

Commanders who call press conferences and have nothing to say, commanders who send dozens of pictures of themselves in various poses, and commanders who write their own copy and want it printed "just that way" are in for a comeuppance. Although what a commander says and does is important, the sayings and doings of his subordinates are also newsworthy. They, too, have had their share of experiences and are capable of doing things worthy of a few lines in the local *Bugle*.

Not many commanders can be accused of hogging all the news space of the local paper, but some do so unconsciously by allowing the news releases leaving their commands to use their names in connection with *everything* that goes on. For example, what do you, as a reader, think when you see something like this:

"Colonel Jake U. Soandso, local air base commander, announced a time-saving invention which one of "his boys," as he calls them, thought up to save Uncle Sam $10,000 per year. . . ."

Although it is good policy to have important news releases made in the name of the commander, it is likewise good psychological policy to spread the glory around a little and give lesser numeraries full credit whenever possible.

III. Thou Shalt Pay Attention to the Queries of Thy Press Lest Ye be Misquoted and Appear as the Fool with All the World to Witness.

Busy commanders sometimes have a tendency to treat inquiries from the press very lightly or even disdainfully. But it never pays. Newsmen have a reputation for unfailing memories and hate the "brushoff" as much as, if not more than, the rest of us.

There is a story that newsmen tell with a chuckle because it points up what can happen to anyone who doesn't take a press query very seriously. At a West Coast base, a reporter from a local paper called the base commander by telephone. He got the base adjutant, who was reluctant to put his commander on the line because he knew his boss was extremely busy. After a short verbal hassle, the reporter succeeded in getting the man he wanted.

"Colonel Smith, this is Jim Jones of the *Daily Blip*. Just wanted to ask you what you thought of the latest quote from Senator Glimp concerning your base here."

"I haven't heard about it," said the colonel hurriedly. "What did he say?"

"Well, we got the word over the news wire that he says he is going to look into your base housing shortage and see if he can't straighten it out," the reporter answered.

"That's funny. We don't have a housing problem here. What's the old boy driving at?"

"Beats me, Colonel. I'll just write up a short item on it for today's paper and quote you that you don't have any housing problem. OK?"

"OK. You do that. There's no problem here that I know of. We can take care of all the troops we'll have here with no sweat, especially after next month."

That evening when the *Daily Blip* came out, the unwary colonel found his name in headlines:

Smith Says Glimp 'Mistaken'

Local Air Commander Completely Surprised That Base Needs Housing—Rumors Out That Base Will Close Next Month

Colonel H. J. "Smitty" Smith, commander of the local air base, let the cat out of the bag early today when he heard of Senator Glimp's remarks concerning an Air Force request for additional housing for his personnel.

This turn-about-face came as a complete surprise to local townsmen today who have been going all-out to build additional housing units on the south side for Air Force families. When queried about the additional funds sought by Senator Glimp to supplement the local housing shortage with a Wherry Housing project, the base commander was completely surprised. He said, "We don't have a housing problem here" and added that he knows that he can take care of all troops to be stationed here, "especially after next month."

Local real estate men were alarmed at the prospect of their investments being lost and swamped the downtown telephone exchange with long distance calls to Washington. The rumors were flying thick and fast at noon today that the base would be completely shut down within three months. Smith could not be reached for further comment. . . .

It took Colonel Smith a long time to talk his way out of that one. *He* thought the Senator and the reporter were referring to *troop* housing *on* the base. The Senator was referring to the very real *off*-base housing problem.

IV. Thou Shalt Not Give False Testimony to Thy Chronicles.

It goes without saying that no commander will deliberately lie to the press. But it isn't deliberate falsification that causes nightmares among commanders. Rather, it is their expressed opinions on military matters that later appear as facts in print that get them into hot water.

Men in uniform are considered experts by the layman. If a problem has military aspects, the man in mufti thinks that the man in uniform should be able to give him all the answers. We in the military know that nothing could be farther from the truth. But civilians, although they won't always admit it, look up to our senior officers and take their honest opinions as the gospel truth simply because those who expressed them were wearing eagles or stars.

An Example

An example of a splendid leader who kept himself in hot water because of his vociferous opinions was the late General George S. Patton. His famous remarks about the "ins and outs" of political affairs in post-war Germany are classics. We can easily recall other remarks made lately by high Government officials which have boomeranged mightily.

So, if a commander doesn't know the answer to a question and expresses an opinion, it must be thoroughly understood that it is an opinion and in no way reflects the official viewpoint. Second-guessing on matters that concern many people may prove disastrous and cause the public to lose confidence in our leaders and forces they represent.

XUM

V. Thou Shalt Be Impartial in All Thy Dealings and Distribute Thy News to All Thy Brethren Alike.

In other words, "Don't play favorites with the press." This trite saying may not mean much to a military man. But newspapers are in competition just as much as shoe stores or hardware merchants are. News is their stock in trade and when they are deliberately left out of the bidding, it hurts just as much as when one manufacturer has been granted a juicy contract without his competitor having been invited to bid.

If the consequences of playing favorites were not so disastrous, the average military man might be inclined to let the chips fall where they may. But the results can prove the undoing of the best of our leaders, for truly, Hell hath no fury like that of an editor scorned.

What might an unfavored newspaper do about being left out on the news-giving? It's not hard to figure out. A cold war of words would begin. The unchosen few might be tempted to look around for bad news to print about the commander or his command. It is disgustingly easy to make headlines out of a simple tale of an airman speeding through a red light or a soldier caught in a brawl in a local night spot. Reporters make their living and their reputations on sensational news. "Sensational" news can be made up by inference, innuendo or slanting. In fact, it is said that a *good* reporter could make a headline item out of *anything* with a little ingenuity and encouragement from his editor.

VI. Thou Shalt Not Forsake Security Lest the Wrath of Thy Superiors Descend on Thy Head.

It is a gnawing temptation for the average human being to want to answer every question put to him by another being. Men in uniform are no exception when they want to oblige newsmen who are asking questions. And when those questions border on the fringes of security matters, the responder who has already been conditioned to giving answers may fall into the trap of answering before he realizes that he has "leaked."

The unwary interviewee may actually give out information indirectly when answering queries by saying, "I'm sorry, but that is top secret information." This kind of an answer makes a reporter prick up his ears, but quick! The questions that will follow are sure to be pointed and phrased another way until an astute interrogator can guess at the facts.

Clever reporters sometimes phrase questions so that they get "Yes" and "No" responses. By so doing, they can sometimes put words into the commander's mouth or at least it would appear so in the evening paper. By the use of indirect quotes it would appear that this commander said more than he actually did:

"Colonel J. B. Johnstone announced today that the 654th Bomb Group is transferring to Germany in a surprise move. Alerted by the sudden disappearance of airmen from town last evening, this reporter queried the base commander and was told that any move of the men to another theater was Top Secret.

Guards at the gates would not comment on the fact that the few men seen inside the base were still wearing their winter uniforms even though summer uniforms are usually required at this time of year.

In declining to comment on the pending move, the much-decorated colonel intimated there are indications war may be imminent . . ."

Imagine the consternation of the commander that night if the reporter had guessed right and it *was* a Top Secret move!

VII. Thou Shalt Treat Thy Dealings With Thy Press as Though Thy Life Were in Danger, For Truly Is Thy Effectiveness Measured in the Pages of Thy Chronicles.

From the moment an accident occurs until it becomes front page reading, the time has been cut from days and weeks to minutes and hours by the miracle of the press wire services. A bad slip, a classified release, a quote of angered words, or a chance photo of an indiscreet act can spread around the world in much less time than it takes to read these lines. Therefore, "caution" must be the watchword of anyone and everyone in uniform when dealing with those who have this miracle at their fingertips.

The power of the press can never be taken too lightly anywhere on the globe. Even the smallest of the farm weeklies have access to the news services when they uncover something really worthwhile. And even their interest in military matters must be taken seriously, no matter how inconsequential it may seem to those in uniform.

The effectiveness of junior officers in our services is measured by their job performance and their leadership ability in getting the job done. But how are our leaders measured? They, too, must be measured by the results they obtain in performing the mission assigned to them. But, is the assigned, written mission everything? What about the *unwritten* mission that everyone in uniform has—that of effecting good community relations with the community he finds himself in? Is not good or bad public relations reflected in the local press? You can bet next month's pay it is. Who would give a commander an "E" for effort when he is damned in every issue of the local gazette?

VIII. Thou Shalt Release Thy News While It Still Breathes The Fire of Life Lest Thy Historians Find It of More Value.

There was a commander of a Southern Army post who was very interested in the activities of his PIO. He continually gave the ambitious major, a graduate of the Army's Public Information School, the benefit of his years of experience as a commander. The general's advice consisted of a scientific study of his imagined impact of all news releases on the reading public. Every release from the information office had to pass over his desk. Many times it would return to the PIO's desk with the remark "Let's hold this for a couple of days," or "Better wait until we find something released by the Department of the Army on this first."

The major was bitter with frustration. His ten years in PIO work and his schooling, not to mention his journalism experience before entering the Army, had earned him an enviable reputation in Army circles. He had never pulled a PIO boner and here the Old Man was taking over his shop. Needless to say, the number of colum

inches in the local papers decreased. Even very interesting stories—interesting when they happened—never appeared in print. The PIO knew why. The Old Man never did.

The old phrase "Get the news while it's news" still holds true in the newspaper business. Reporters have lost jobs trying to foist off on their editors items that were ancient history. Editors get apoplexy when anyone tries to persuade them to print an old item.

But what is sometimes worse than getting old news is to have someone hold up news *when the press already knows* that something has happened and wants to verify it by seeking the words of the commander himself. Reporters trying to make deadlines who can't get the facts have to guess at what happened or use a "hedge phrase" such as "reliable sources indicate." This, of course, can be much worse than the truth.

Actually, some news is most valuable before an event. Let's take the case of a master sergeant retiring after 40 years of honorable service. A review is to be held next Saturday morning. A small announcement of the review could be made in Wednesday's paper. On Friday night another announcement is made of the review and a general invitation is made to the public. At the same time, a story on the sergeant may be run with his picture. The press by this time would have been extended an invitation to send reporters and photographers to cover the event. All of this would have added up to about 20 inches of space with at least two pictures. If no advance releases had been put out and the base PIO had taken his own pictures of the review, then held them for three or four days, he would have been lucky if *anything* was ever printed on this story.

IX. Thou Shalt Not Force On Thy Chronicles News They Do Not Want. For Verily They Can Cuttest Off Thy Water When Thou Thirstest Most.

Probably there is nothing more obnoxious to a newspaperman than a person who insists that his paper print an item. It might be a local dowager marrying off a daughter who wants "their" wedding to receive top billing on the Sunday society page, or the publicity chairman for the American Legion who wants their annual picnic to get some photo coverage. But there is nothing that will make an editor blow his top like a military commander or his subordinates telling him to "Print this in Saturday's edition" or "We want this to appear in your sports section along with your national sports write-ups." Even if he does comply with requests like these, you can bet your bottom dollar it will not be *exactly* as it was requested.

One of our heritages is the right of freedom of speech. This freedom is demonstrated to us every day through our news media. By tradition, editors and newsmen are fiercely independent. *No one* will tell them what they can print and cannot print and woe betide those luckless ones who try!

Any commander who attempts to give directives to the local papers as he does his own command and who is as brusque with them as he would be with a Sad Sack appealing for a three-day pass, will find retaliation taking place in subtle ways. When this commander *really* has something he would like desperately to see in print and which an editor could take or leave as far as news value goes, you can easily guess what would happen. News editors have an exasperating way of laughing up their sleeves and they take special delight in seeing almighty military men fry in their own sweat.

X. Thou Shalt Surround Thyself With Worthy Persons to Act For Thee in Thy Routine Dealings With Thy Chronicles.

The man a commander selects for his Informational Services Officer (or whatever his title) should possess three main qualities above all others: interest in the job, initiative, and common sense. Education and experience are additional valuable assets, but without the first three qualities a commander should keep looking for a candidate.

The PIO staff, even if it consists of only one man, should always be accessible to the press. The PIO's everyday relations set the stage for the occasional important relations that the commander will enjoy (or regret) when he gets into the act on the unusual stories.

Although it helps if a PIO can turn a good phrase, it is better yet if he has the knack of "seeing" stories on his base and then *leading the press to them*. Every base and every person on that base is a potential story and a good PIO will find them. Thus, it is a wise commander who seeks to have the sharpest kind of officer and enlisted man acting for him in routine press dealings, for it is they who will make his life easier when he is faced with the most critical and analytical of all human beings—a newspaper reporter.

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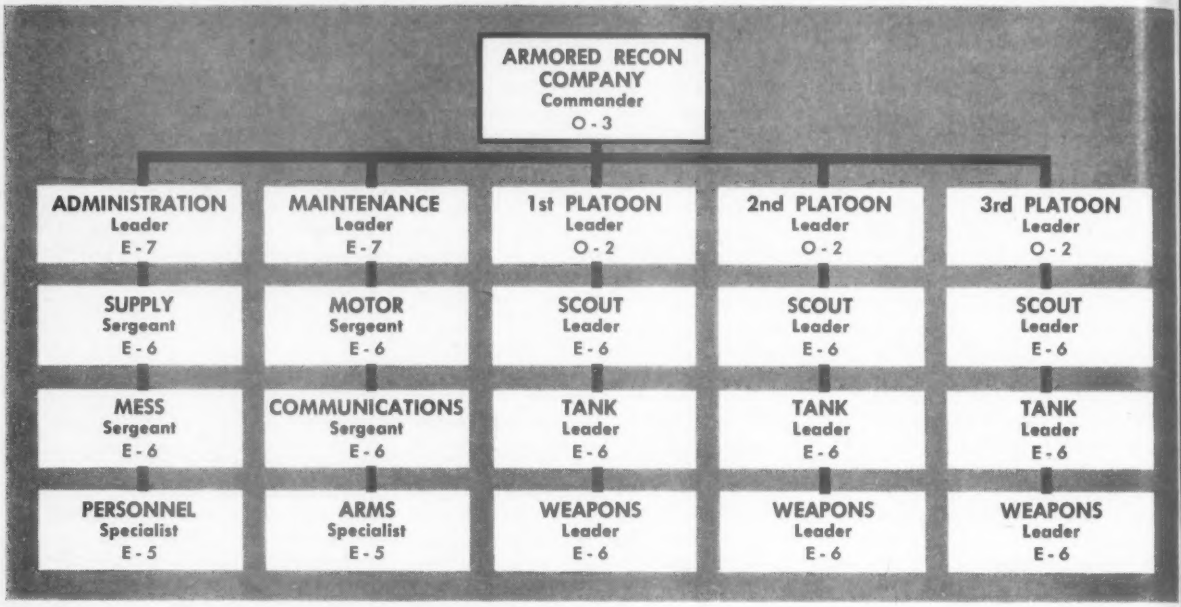

Here is the new organization design the author suggests.

The Army Company—A Management Antique?

by Patrick Kimball

THE PURPOSE of the Army company as an organization is to provide the smallest optimum combat unit with integral activities of administration and maintenance.

The company is regarded traditionally by the Army as the building block of the entire organization structure, from both administrative and operational viewpoints. As such, it should be simply designed and easy to run. *Unfortunately, the company is a management and organizational monstrosity.* In it lie the foundations of literally all the problems of the Army today. It is a relic of Washington's day on horseback, loaded down with the equipment and the complexities of the modern age. The company last served a useful purpose in its present form during the Indian Wars.

Criticism comes easily; my purpose is to suggest how the company can be salvaged in something resembling its present structure. It is worth rebuilding, because a grouping of 100 to 200 men in combat provides a good focus of comradely loyalty and esprit, so vital to success in battle. Despite all shortcomings, I enjoyed my tenure as CO of "B" Troop, 3d Cavalry, more than any other assignment in the Army, almost solely because of unit pride which we developed. As an exercise in management, however, it was an appalling experience.

Consider first the position of company commander. He is held accountable for the results of many decisions which he does not make. This is absurd, yet some instances are detailed carefully in Army regulations. For example, the company commander is held pecuniarily liable for all property issued to and used by members of his organization. In effect, he must pay out of his own pocket for any missing items whose loss cannot be explained satisfactorily. As the book value of company property may be in excess of 10 million dollars, various dodges have been created to save the CO from becoming a lifetime serf of the Government. (I had better explain here that I have no axe to grind; I handed over my company property intact to my successor. At least we hoped it was all there; we inventoried for 30 days while much of the equipment was being used daily in training.)

One of the better known procedures is to "sign out" property to subordinate commanders who have even less of an opportunity to guard it physically than the CO has. Frequently zealots with company pride and few scruples steal property in quantity

About the Author

Patrick Kimball was graduated from West Point in 1949 and served in the Army for five years in Germany and the U.S. His last assignment was as CO, Company "B," 3d Armored Cavalry Regiment. He worked for the Aluminum Company of America for three years as an industrial engineer and production supervisor. Concurrently, he studied for an MS in management engineering at New York University. Kimball is now a management consultant with the Aircraft Nuclear Propulsion Department of the General Electric Company in Cincinnati.

from company neighbors, who, in turn, usually steal it right back.

At least it is being used by someone. Far worse is the CO who becomes petrified of losing his shirt and locks up anything that can be lifted. Nobody can use movable items except by signing away his life and fortune. Thus the use of complex equipment in training is lost, and taxpayers' money becomes even more locked up in dead inventory.

There is only one solution to this problem—simply abolish the nonsense of personal liability and control Army property through routine methods of inventory control. Pilfering, embezzlement, and willful neglect are crimes, and wrongdoers can be punished through judicial proceedings.

Managerial Impotence

Another example of the commander's managerial impotence is in control of his personnel. Salary adjustments are completely out of his hands; merit increases do not exist. And yet, like any manager of any kind of activity in the world, he achieves success solely through the results of the organized effort of those reporting to him.

Add to these handicaps the responsibilities of administering, supplying, feeding, training, and leading in battle, and it can be seen that the company commander is a fantastically overloaded executive in the light of modern management techniques. The Army's solution to the limitations of the 24-hour day is to make the company commander three men.

The post of company executive officer, where it exists, was created "to take some of the load off the old man" and to provide an immediate replacement in the event the CO becomes a casualty. The latter never works as expected, for in combat the executive officer manages supply and maintenance and knows a good deal less about the tactical situation than any of the platoon leaders. The company always suffers a real jolt to its continuity of effort on the loss of its commander.

As for the other purpose, the XO is the commander's creature. He has no charted responsibilities or authority and is accountable only to his commander. His job depends upon his own functional knowledge and the commander's fears and whims. He usually attempts to manage supply and maintenance in training while the CO takes the field, but quite often he knows too little about either to be effective and gets transferred anyway before he learns too much. (As a company executive officer, I was of little help to my commander, and I received not much more from my own XO.)

There are other officers in the Army company—the three platoon leaders. These young men should not be used in any other capacity, for they are usually relatively new and inexperienced. Upon them rests most of the burden of unit training, and they in turn must receive training in leading a combat unit. Often, the CO attempts to assign some portions of his management duties to them for experience. The practice becomes dangerous when they complete the learning process and begin to do something.

Underlying the officer strata in the company are the real functional managers—the noncommissioned officers. These men actually perform technical direction of service groups and lead combat subunits. Whereas the commanding triumvirate resembles a French cabinet, and changes composition as often, the noncoms are the stolid bureaucrats who really run the organization. As the old cavalry sergeant said, "Troop commanders come and go, but it don't hurt the troop none."

Double Standard

Leaders of the Army have a strange double standard in regard to the performance of noncoms. The Army worries a great deal about their training, pay, professional status, and retention. "Noncommissioned officers are the backbone of the Army," is a proud old motto. But no one believes it, least of all the noncoms themselves, for the Army simply does not trust them to manage. An officer's signature is required to authorize almost every piece of action paper in Army procedures. Never mind whether the officer is qualified, has real functional knowledge, or what his position is in the organizational structure. Get an officer's signature.

Can it be wondered why the noncom is a perpetual cynic who bucks all decisions, no matter how minor, to the nearest officer? Except in tactical leadership of small units, he has no responsibility and no authority. How did this practice arise?

We must search back into the history of English and continental armies of the seventeenth and eighteenth centuries, from whom our military traditions were derived. Then company officers were real gentlemen who had absolutely nothing to do with management of troops. They took their place at the head of their units, on horseback, only on the march and in battle. At all other times the noncommissioned officers ran the company—literally. They trained, administered, supplied, maintained, etc. They were real professional leaders. Only in the French Foreign Legion does this ancient tradition survive intact.

As our American officers became more democratically minded, and management of troop units became more complicated, the strata of officers settled down on the company with a smothering effect. Noncoms were downgraded, while officers, at least, retained professional distinction. The practice of officer certification of documents arose and increased the injury to the noncom group. Noncoms have, by and large, become men who draw pay for managerial work which they must do but are not officially allowed to do. The fiction of noncom management of the company lingers as a trace in the passage of directions for very minor housekeeping tasks through the first sergeant to platoon sergeants, bypassing the officer structure.

Suggested Change

Through the medium of organization design, much of the debris of 100 years can be swept away. Let those who manage, really manage in an Army company. The organization chart for an armored reconnaissance company at the beginning of this article gives a picture of the new design. Superficially, it resembles the present structure, but the differences are enormous. The company executive officer, the administrative warrant officer, the first sergeant, and all the platoon sergeants are gone.

Functions of the new company are administration, maintenance, and operations. Tactical integrity of operating components is retained through the three platoons with their leaders. But the functions of administration and maintenance are given into the hands of the men who should be solely responsible to the company commander for their performance. Considering the homogeneity of functions and their relative importance, supply, mess, and personnel are grouped under the administration leader; and motor, communications, and arms under the maintenance leader. The two leaders are noncommissioned officers one grade above the sections they supervise. The positions of administration and maintenance leaders are a logical career advance of service supervisors. To advance to these positions requires a broadening and self-developing process. These leaders must be given the authority and responsibility to manage their sections, to get their job done. They must come through the technical ranks in order to gain the experience they need. Their career patterns are quite apart and distinct from combat

XUM

leadership. Indeed, it should be a rare occasion when a noncommissioned officer can transfer from one to another.

It might well be argued that the operational components could be led by noncoms also. I believe they very well could be, and perhaps ought to be, but the educational process of combat arms officers does not equip them to move directly into the position of company commander. In order to provide career incentive for combat noncoms, however, an opportunity must be given them to advance to the highest pay grade. This does not mean the retention of the useless function of platoon sergeant. The senior noncom in each platoon should be prepared to replace the platoon leader, as the senior platoon leader should be prepared to replace the company commander. But both have their own components to lead and must direct their energies to their leadership.

Adoption of the new design for company organization does not require revolutionary changes in Army training methods and career patterns. It does dignify the work of noncommissioned officers by raising them to professional status as administration, maintenance, or combat leaders. It places responsibility on the men who manage and gives them the authority to act in accordance with company objectives. It requires professional performance so that the company commander can rely on their work for effective operation of the company. It relieves the commander of the necessity of becoming an expert in service fields and allows him to manage his services and direct the training and operation of his combat units.

Recent plans for reorganization of Army divisions, regiments, and battalions into more mobile, flexible groupings increases the value of the Army company. A combat company may now be shifted from control by one battle group to another in the midst of an operation. It may have to move rapidly and shift its sources of supply overnight. It may be isolated for long periods. These conditions have always existed at times in war, but a nuclear war on any scale requires a strengthening of the self-sustaining capability of the company.

To be prepared for all situations, the Army company must be strong as an organization—that is, simple, direct, and well-managed. Each man's responsibilities must be clearly defined and understood by everyone. Each officer, noncom, and fighting man must do his share and more to survive . . . and to win.

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PIGTAIL SPLICE DATA: A new data sheet describing the BURCAP, a compression-installed, insulated fixture-type splicing connector, is available from the Omaton Division of Burndy Corp. Bulletin lists complete test and dimensional information, describes hand and bench-mounted tooling available for BURCAP installation.

For more facts request No. 10 on reply card

TRAVELING-WAVE TUBE: A new version of RCA's very lightweight, electrostatically-focused traveling-wave amplifier tube will be available in the near future to equipment manufacturers for developmental tube sampling. The tube can be used in applications involving airborne radar, airborne electronic countermeasure equipment, and portable ground-operated microwave communications systems.

For more facts request No. 11 on reply card

DESK: Product Development Corp. is now marketing a "vehicular desk," an adjustable 8" by 12" aluminum construction, with 1" deep basket welded to underside, full 90 degree up and down indexing from horizontal or writing position; spring wire mounted in pencil holder retains completed payers in basket; clip at top of desk holds paper work in delivery sequence.

For more facts request No. 12 on reply card

CLEANING DEVICE: Labor savings up to 80% are claimed for a completely new cleaning device, using compressed air. A unique valve arrangement allows the user to switch instantly from a solution application (cleaning or sterilizing solution) to pressure rinse (clear water) and to air dry if desired. Device weighs less than 3 pounds.

For more facts request No. 13 on reply card

POWER SPEAKER: A new transistorized "Big Voice" power speaker announced by Motorola increases the effectiveness of two-way mobile radios by extending the listening range hundreds to thousands of feet, allowing the driver to hear messages even when working away from his parked vehicle. And by turning a control, the speaker is converted into a public address system with a half mile or more range.

For more facts request No. 14. on reply card

WORK SIMPLIFICATION: A Master Work Simplification and Automation Study Laboratory is available from Alden Systems Company. Company claims it enables quick move from product idea stage to complete production, eliminates much of the estimating, guess work and extra stages or steps in developing a product.

For more facts request No. 15 on reply card

NEW LITERATURE: The third edition of the Office Automation handbook for users or potential users of automated office machines and systems is now available. It is a classified handbook providing concise information on new office machines and processing systems with a monthly updating service to keep the book current. In addition to an extensive Hardware Section, the handbook also contains: Commercial Aspects, Sociological Section, Scientific and Development Sections.

For more facts request No. 16 on reply card

SMALLEST RECHARGEABLE BATTERY: The smallest rechargeable sintered plate, nickel-cadmium, button cell battery has been introduced by Gulton Industries, Inc. Not much larger than a half-dollar, the hermetically sealed button cells were developed specifically for miniature and subminiaturized electrical and electronic applications. Designed for the aircraft missile field for testing, telemetering, radio applications and emergency lighting.

For more facts request No. 17 on reply card

New Radar System

A new, highly portable, tactical early warning (TEW) system—which promises to extend radically the nation's tactical defense perimeters—is being developed for the **U.S. Marine Corps** by Sperry Gyroscope Co.

The long-range search and height-finding radar system will detect close-in or distant high-speed enemy aircraft and missiles. The lightweight system is being designed to satisfy the Marines' requirement for helicopter transportable equipment.

• The final and decisive element in warfare is not the weapon, not the equipment but is the men who operate and use the hardware.

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NEW! THE CAT* NO. 7G BULLDOZER

Blade tilts 3′ to either side!

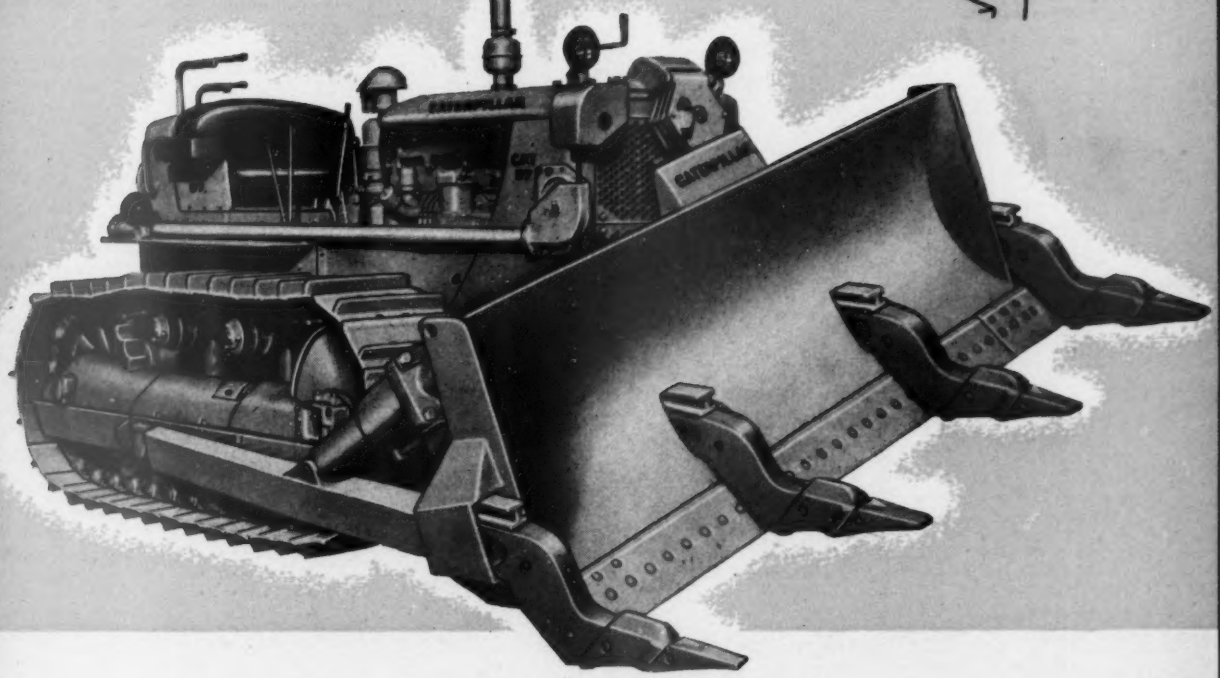
Teeth slice through hard materials!

Blade tips through a 16½° arc!

Teeth easily removed!

Teeth pick up and carry!

Handles easily!



'DOZER AND RIPPER IN ONE

The brand-new Caterpillar No. 7G Bulldozer is a completely different type of bulldozer. The amazing tilt-tip action, and its four heat-treated cast steel teeth, are an entirely new concept in 'dozing. The Gyrodozer is both a 'dozer and a ripper.

YOU'LL GET HIGHER PRODUCTION

The Gyrodozer rips through hard or frozen materials. Its 23″ teeth not only pry out boulders but pick 'em up and carry 'em away. In rocky soil, the wedging action of the teeth surfaces small rocks for scooping up by the 10′ 10″ blade. On the really tough jobs, the tractor's full horsepower can be put behind a single tooth. The Gyrodozer is ideal for uprooting trees and clearing an area in a hurry.

EASY TO OPERATE

A Cat No. 25 Cable Control raises and lowers the 'dozer and a front-mounted No. 44 double-valve Hydraulic Control tips and tilts the blade. The operator never needs to leave his seat to make a blade adjustment.

GET FULL DETAILS

on the revolutionary new Gyrodozer, the completely new kind of bulldozer from Caterpillar.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

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THE HARD WORK

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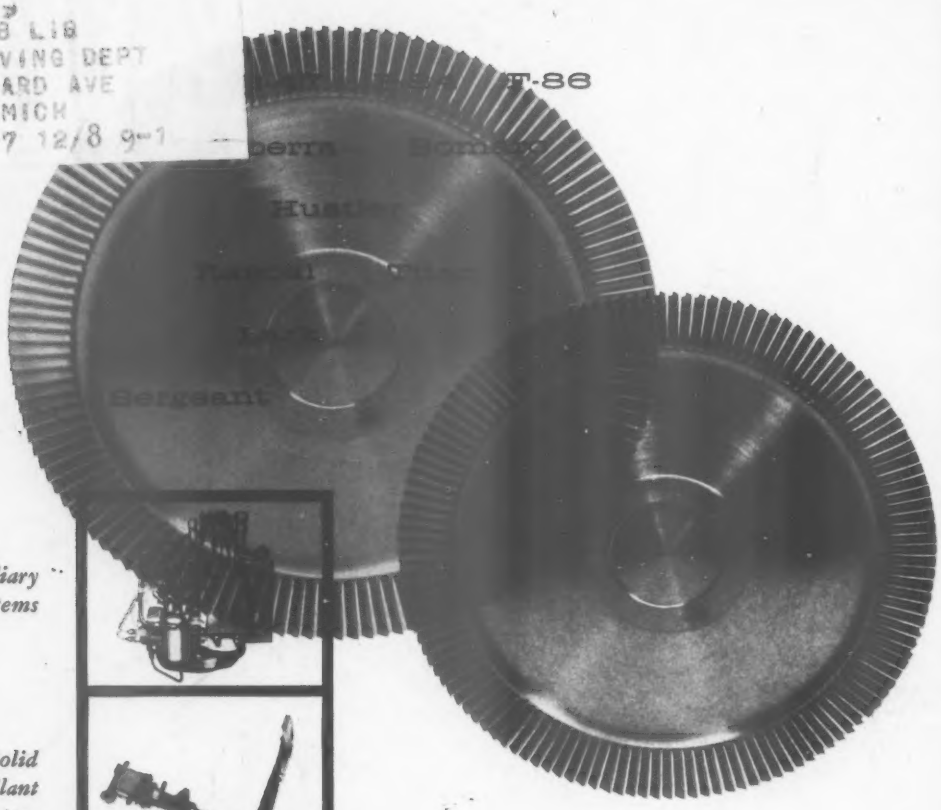
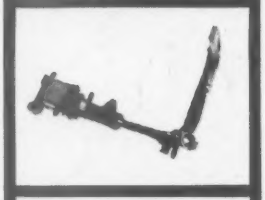
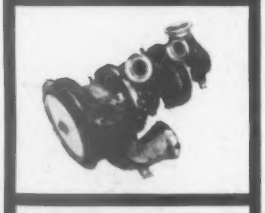


Auxiliary Power Systems

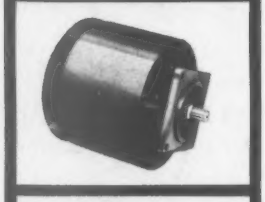
Liquid and Solid Propellant Gas Generators



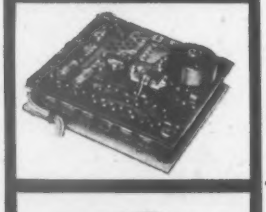
Turbines, Pumps, Gearboxes, Controls



Brushless Alternators



Electrical Components



Ground Support Equipment

turbo-machinery for missiles and aircraft

Aerojet-General Corporation offers 15 years of unequalled experience in the development and manufacture of turbo- and electrical machinery for airborne vehicles—an organization with complete capability in the field.

turbo-machinery division

Aerojet-General

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A Subsidiary of The General Tire & Rubber Company

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